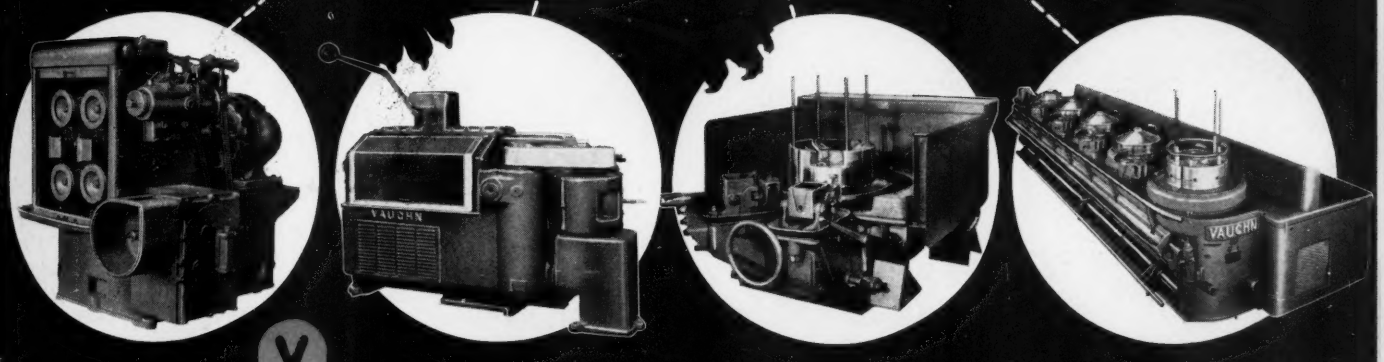
WIRE AND WIRE PRODUCTS

MARCH 1945



Vaughn

WIRE DRAWING MACHINERY

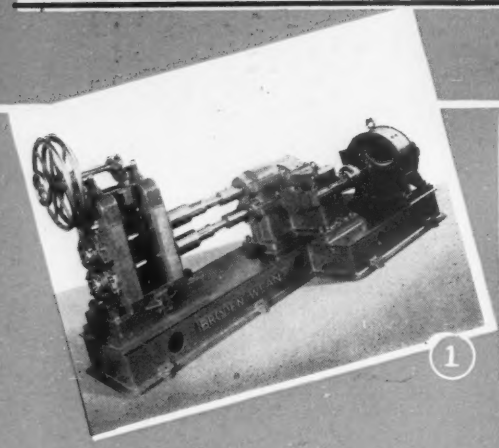
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

The demand for *performance* in wire production never grows less. Efficiency and dependability in VAUGHN Wire Drawing Machinery are recognized cardinal qualities—joining with Vaughn *versatility* to meet the most exacting requirements of the industry in producing wire of every type and grade.

THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO

OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

WEAN-BRODEN



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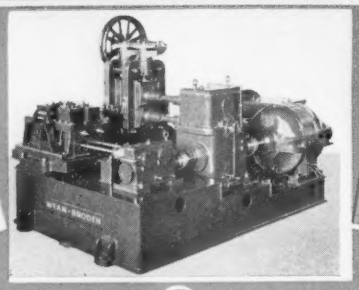

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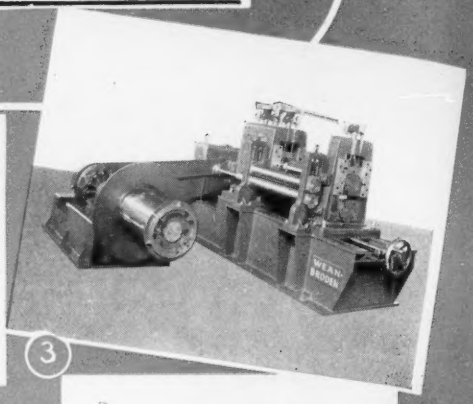

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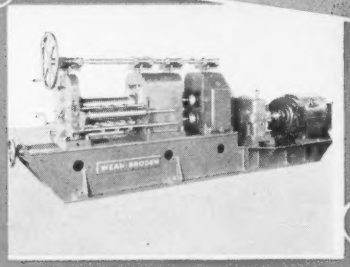


4

THE Wean Engineering Company, Inc., have long been recognized as Specialists in sheet, strip and tin mill equipment. . . . The Broden Construction Company specializes in the manufacture of narrow strip and wire mill equipment.

With the extended facilities of The Broden Construction Company as a subsidiary of The Wean Engineering Company, Inc., it is now possible to serve the steel industry more effectively.

1. Small Cold Rolling Strip Mill
2. Special Strip Cold Rolling Mill
3. Strip Reel and Slitting Unit
4. Heavy Duty Slitter
5. Special Alloy Single Draft Heavy Duty Vertical Wire Drawing Block for 5/8" Round Rod

COLD ROLLING MACHINERY

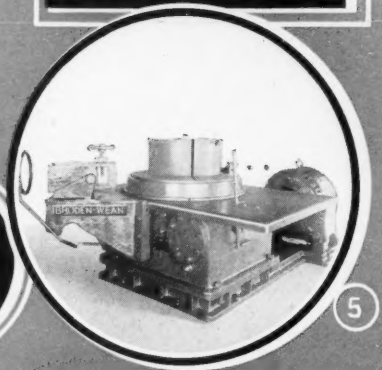
For 36" Wide Material and Narrower

Mills • Reels • Slitters • Levelers • Coilers • Edgers
Scale Breakers • Shears • Scrap Ballers
Continuous Pickling

WIRE MILL EQUIPMENT

Wire Drawing Machines • Patenting • Galvanizing and Tinning Take-Up Frames • Wire Flattening • Spoolers
Nail Galvanizing and Blueing

HOLMQUIST BARBED WIRE and WIRE FENCE MACHINERY



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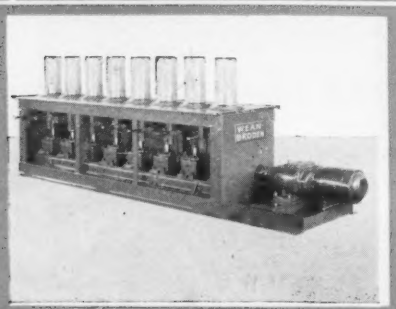
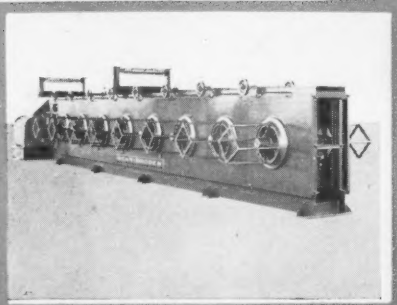
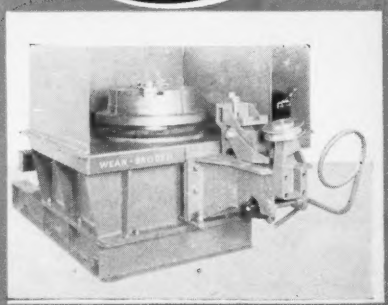
The BRODEN CONSTRUCTION Co., Inc., Cleveland, O.
A SUBSIDIARY COMPANY OF
The WEAN ENGINEERING Co., Inc., Warren, O.



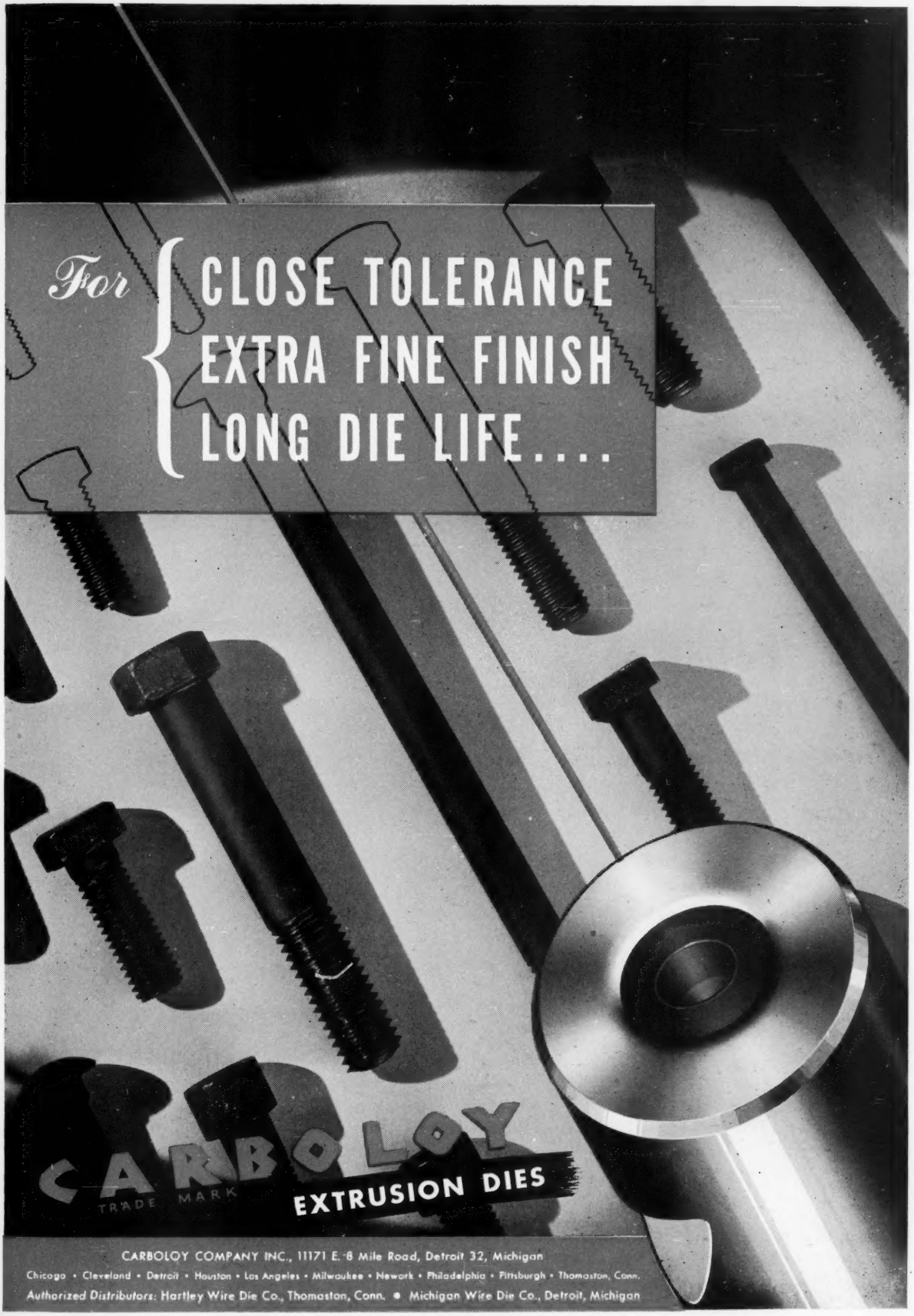
FINE WIRE TINNING UNIT

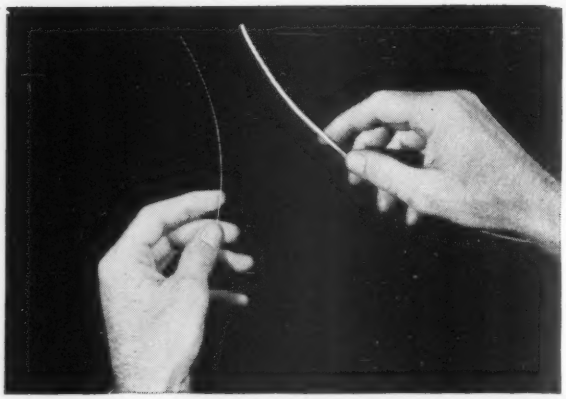


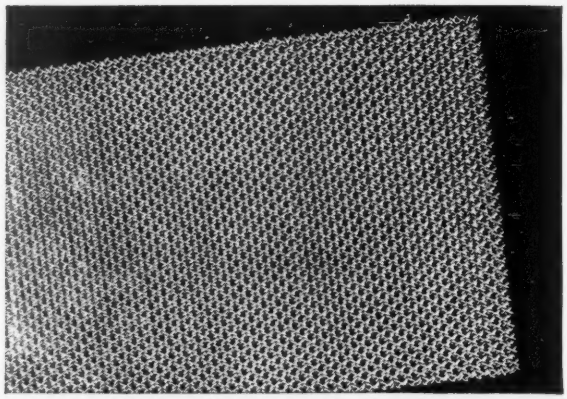
MULTIPLE WIRE TAKEUP FRAME

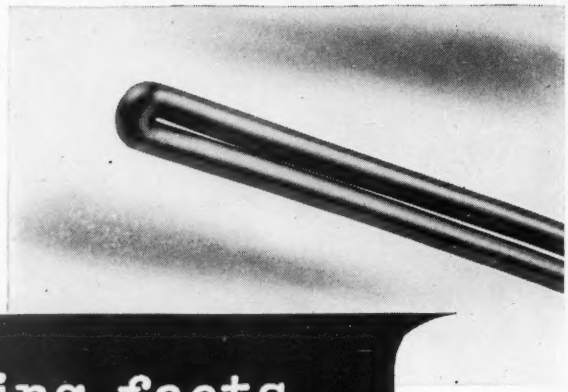


TWO DRAFT CONTINUOUS WIRE DRAWING MACHINE


For
CLOSE TOLERANCE
EXTRA FINE FINISH
LONG DIE LIFE....
CARBOLOY
TRADE MARK
EXTRUSION DIES
CARBOLOY COMPANY INC., 11171 E. 8 Mile Road, Detroit 32, Michigan
Chicago • Cleveland • Detroit • Houston • Los Angeles • Milwaukee • Newark • Philadelphia • Pittsburgh • Thomaston, Conn.
Authorized Distributors: Hartley Wire Die Co., Thomaston, Conn. • Michigan Wire Die Co., Detroit, Michigan







4 outstanding facts about bethanized wire

Without any harm whatsoever to the zinc-coating, bethanized wire can be:

1. *drawn to a fraction of its original size*
2. *wrapped around its own diameter*
3. *bent back flat upon itself*
4. *formed into intricate shapes*

Bethanized wire is able to pass muster after these drastic tests because of the remarkable ductility of the bethanized coating. The bethanized coating is 99.9+ per cent pure zinc, and is applied by an advanced electrolytic process which applies the zinc uniformly both along and around the wire. There are no thin spots in the coating where rust might start.

Because of the purity and uniformity of the coating, bethanized wire is highly resistant to corrosion. For maximum protection where atmospheric conditions are unusually corrosive, coatings can be used two and three times as heavy as those specified for conventional Type 3 galvanizing.

Enormous quantities of this versatile zinc-coated wire are today providing strength-building sinews for assault wire, armoring submarine cables and performing hundreds of other war-related tasks. Many of the applications of bethanized wire had previously been thought impossible for any zinc-coated wire.

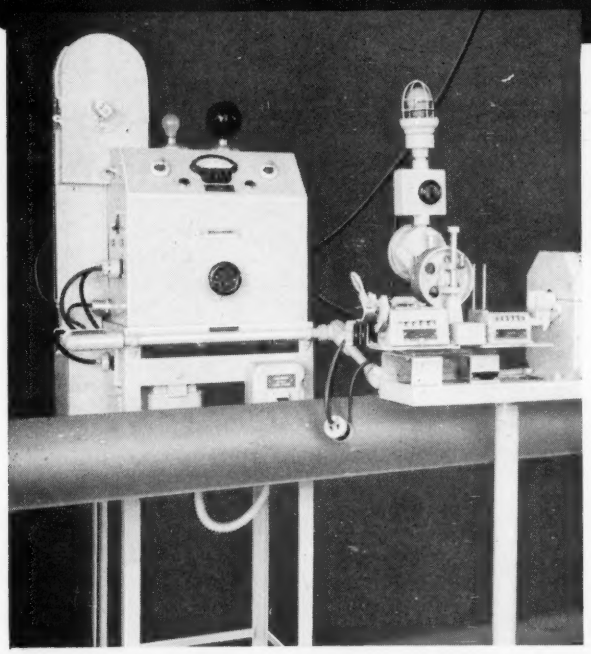
BETHLEHEM STEEL COMPANY, Bethlehem, Pa.

BETHLEHEM STEEL

Bethlehem Steel Export Corporation, New York City

JLE

SPARK-TESTING, MEASURING AND RECORDING EQUIPMENT FOR USE ON CONTINUOUS VULCANIZING AND PLASTIC EXTRUDING MACHINES



EXCLUSIVE FEATURE

GUARANTEED TO MEET ALL NAVY, SIGNAL CORPS, UNDERWRITERS', CANADIAN, BRITISH AND RUSSIAN SPECIFICATIONS FOR SPARK-TESTING.

OTHER EXCLUSIVE FEATURES:

1 Records number of insulation faults in each reel as a permanent record on a paper tape.

2 Gives positive lamp signal to indicate whether each reel, as it is finished, contains any faults, or has been subjected to an interruption of power on the sparker.

3 Indicates total faults, reels and footage produced each day or shift.

4 Gives lamp and buzzer signal, as end of a predetermined length is reached on each reel.

5 Can be adapted to initiate an automatic change-over from one take-up reel to the other at a definite length.

6 Maintains maximum sparker-fault-circuit sensitivity without adjustment of any kind for varying wire and atmospheric conditions.

Send for specification sheet.

JAMES L. ENTWISTLE CO.

43 CHURCH ST., PAWTUCKET, R. I.

WORLD'S LEADING MANUFACTURER OF SPARK-TESTING EQUIPMENT

The Wire You Wanted

An American Truck lifts an assault boat off a submerged bridge over the Moselle River. Note the reel of wire rope on the front. Official U. S Signal Corps Photo.

MAYBE it's lifting sunken equipment out of flooded streams, rescuing sabotaged vehicles, pulling guns out of mudholes. Maybe it's lashing cargo to ships, tethering barrage ballons, or doing another of the thousands of jobs at which wire rope works overtime for the Army and Navy. For much of the wire you wanted and couldn't get has gone into wire rope for the Armed Services.

Always a large supplier of wire for wire rope, Youngstown mills are now producing at maximum capacity to help meet America's needs for this extremely vital war material--at the same time maintaining those exacting standards of quality that have given Youngstown Yolectro high carbon rope wire its enviable reputation for excellence.

Whether it is wire for today's needs or post-war, we want to talk to you. Our modern plant equipment, our experienced personnel, our knowledge and ability are at your service, to meet your most rigid requirements-now and in the future.

YOLOY TRADE MARK YOUNGSTOWN STEEL

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Wire - Nails - Tie Plates and Spikes - Pipe and Tubular Products - Conduit - Sheets and Plates - Coke Tin Plate - Electrolytic Tin Plate - Bars - Rods

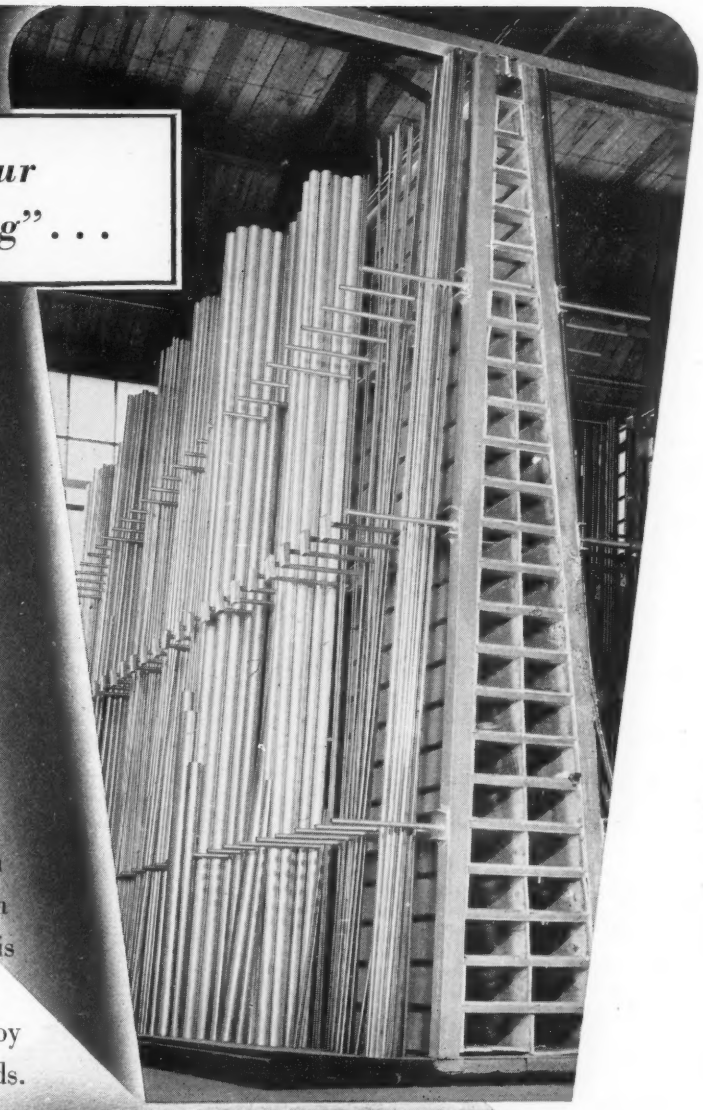
It's so good, "we eat our own cooking"...

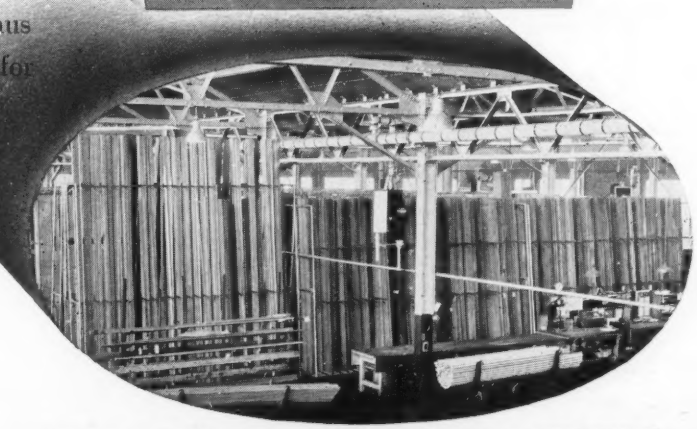
ALCOA ALUMINUM
SCREW MACHINE STOCK

We *know* from our own experience it's good—uniform in cutting characteristics, composition, physical properties and tolerances.

It's been Alcoa's business to learn all there is to know about various aluminum alloys suitable for screw machine work. That's why, when an operator runs into a problem for which he doesn't have the answer, Alcoa is the logical place to look for help.

Free-cutting Alcoa Aluminum Alloy 11S-T3 permits high machining speeds. Couple the low manufacturing costs thus obtained with the lower costs per piece for the stock (aluminum weighs only one-third as much as the heavy metals) and you should be able to show sizable savings on finished parts. ALUMINUM COMPANY OF AMERICA, 2193 Gulf Building, Pittsburgh 19, Pennsylvania.





Aluminum is available *now* to meet your requirements

ALCOA FIRST IN **ALUMINUM**

Tantalum – Tungsten

CARBIDE DIES

MORE TONNAGE
•
BETTER FINISH

Time spent in shut-downs for die changes, and for polishing and re-cutting dies — all affect production. Tantalum-Tungsten Carbide has a definite lubricating action — it reduces the tendency of the wire or rod to gall and seize as it passes through the die. Result: A smoother finish free from score marks. Use Vascoloy-Ramet *Tantalum-Tungsten* Carbide Dies for better finish and increased production.

VASCOLOY RAMET CORPORATION

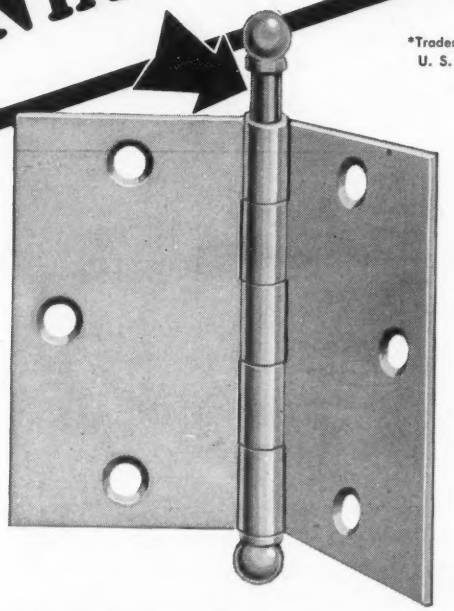
CARBIDE TOOLS and TANTUNG CAST ALLOY CUTTING TOOLS
NORTH CHICAGO, ILL. · SALES & SERVICE IN PRINCIPLES CITIES

4509

THERE'S A BIG DIFFERENCE IN SIZE . . . BUT BOTH ARE CONTINENTAL* WIRE

*Trademark registered U. S. Patent Office

CONTINENTAL STEEL CORPORATION ★ SUPERIOR WIRE



THE WIRE OF A THOUSAND USES

The versatility of Continental wire is apparent when you look at the illustrations above. There is not only a big difference in the size of the wire in the match book and the pin in the door hinge, but there is a big difference in the temper, analysis, and finish. Continental wire for each of these applications is made especially to meet the individual requirements.

Continental specializes in producing wire in a vast variety of shapes, tempers, analyses, and coatings to fit the particular specifications of hundreds of products. You are invited to take advantage of this service. Write or wire today for complete information.

CONTINENTAL
STEEL CORPORATION
GENERAL OFFICES • KOKOMO, INDIANA

PRODUCERS OF: MANUFACTURER'S WIRE: Bright, Annealed, Galvanized, Coppered, Tinned, Liquor Finished, Lead Coated, Special wire, etc. Also Chain Link Fence, Nails, etc. STEEL SHEETS: Black, Galvanized, Hot Rolled Annealed, Hot Rolled Pickled, Long Terne, Copperior, Lead-Sealed, Galvannealed, Super-Metal, etc.

THE SUPERIOR SHEET STEEL COMPANY, *DIVISION* • CANTON, OHIO

Second of a series of Artzybasheff's impressions of the manufacture of steel wire products

Enlarged reproduction free on request

"HEAT O.K.!"

These are the words the melter and his crew of skilled steelmen have been waiting to hear. During the hours between the charging and tapping they have been watching the heat, taking samples for laboratory analysis, checking to bring the carbon, manganese, phosphorus, sulphur and other elements within the desired range.

The siren blows and the tapping begins. Molten steel fills the ladle and slag overflows into the thimble. Soon the steel will take form as ingots, which, after extensive processing, will evolve into wire.

A lot of trouble? Not at all. In fact making our own steel prevents trouble. For, as makers and processors of wire, we at Wickwire Spencer know that unless wire is uniform in size, tensile and stiffness, machines take a beating and the finished product may not be up to standard.

Whether you want a soft, ductile wire or one that's hard and tough, we can meet your requirements. Our metallurgists will determine the service requirements of your wire, prepare the formula and check results to see that the wire is right before it's shipped.

If you want steel wire of any size, temper, analysis of finish; round or shaped; send your order or inquiry to Wickwire Spencer and you'll know why so many of our customers have been reordering our wire for years.

Send your wire questions to

WICKWIRE SPENCER STEEL COMPANY

500 FIFTH AVENUE, NEW YORK 18, N. Y.

Abilene • Buffalo • Chattanooga • Chicago • Detroit • Houston • Los Angeles • Philadelphia • San Francisco • Tulsa • Worcester

NEW

STANDARD WIRE DRAW

No. 3

FOR rods, patented and processed wire, low or high carbon.

A high melting point Compound that will not break down under high speeds or temperatures, yet soft enough to pick up on patented or processed wire.

For a number of years we have endeavored to make our very high titre (melting point) fats into a compound soft enough for the finer sizes of patented or processed wire. This we are now able to do and this is what we are offering in STANDARD WIRE DRAW NO. 3.

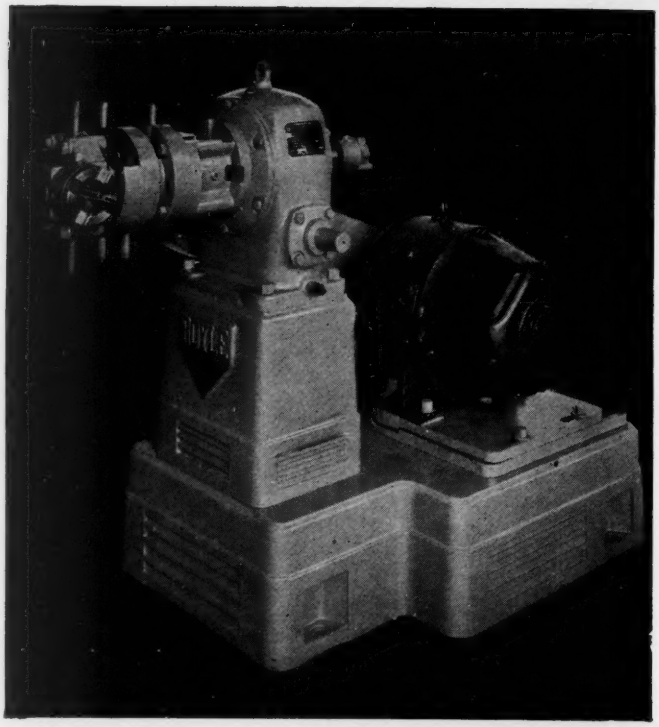
Economical—price comparable with ordinary soaps.

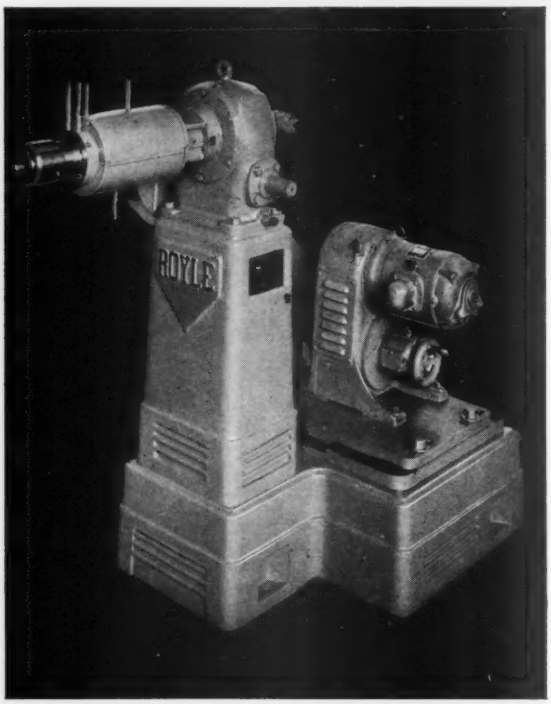
Furnished course or medium grind for rods, fine grind for patented or processed wire.

For further information address

STANDARD INDUSTRIAL COMPOUNDS CO.
4600 W. Ferdinand St. • Chicago 44, Ill.

DESIGNED FOR EXPERIMENTAL AND PRODUCT EXTRUDING





● Rugged is the word to describe these compact and highly efficient Royle Continuous Extruding Machines — the No. ½ and No. 1. Their diminutive size embraces all of the characteristics required for larger and heavier extruding processes.

● Primarily designed to become an integral part of laboratory equipment — the technician can be sure that his experiments will have true relation to actual product extruding — these machines are efficient and economical producers of such commercial products as tubes, rods, fine wire insulation, mono-filament and thread coating.

● Except for dimensional differences these machines possess identical characteristics.

ARMY E NAVY

JOHN ROYLE & SONS

ROYLE PATERSON N. J.

PIONEER BUILDERS OF EXTRUSION MACHINES SINCE 1880

Continental Europe
James Day (Machinery) Ltd.
London, England

Home Office
B. H. Davis J. W. VanRiper
SHerwood 2-8262

Akron, Ohio
J. C. Clinefelter
UNiversity 3726

PATERSON 3, NEW JERSEY

☆ TOLL CALL TO TOKYO... *collect!*

PHOTO U. S. SIGNAL CORPS.

With every resolute stride our valiant men take into enemy territory, a fine, highly flexible Spencer-made wire goes forward with the fighting vanguard. From front lines to command posts, streams of important messages flow in an ever increasing torrent destined soon to deluge Tokyo and Berlin. And when the final military call goes through, it'll be "collect" . . . for the Axis enemy.

SPENCER WIRE

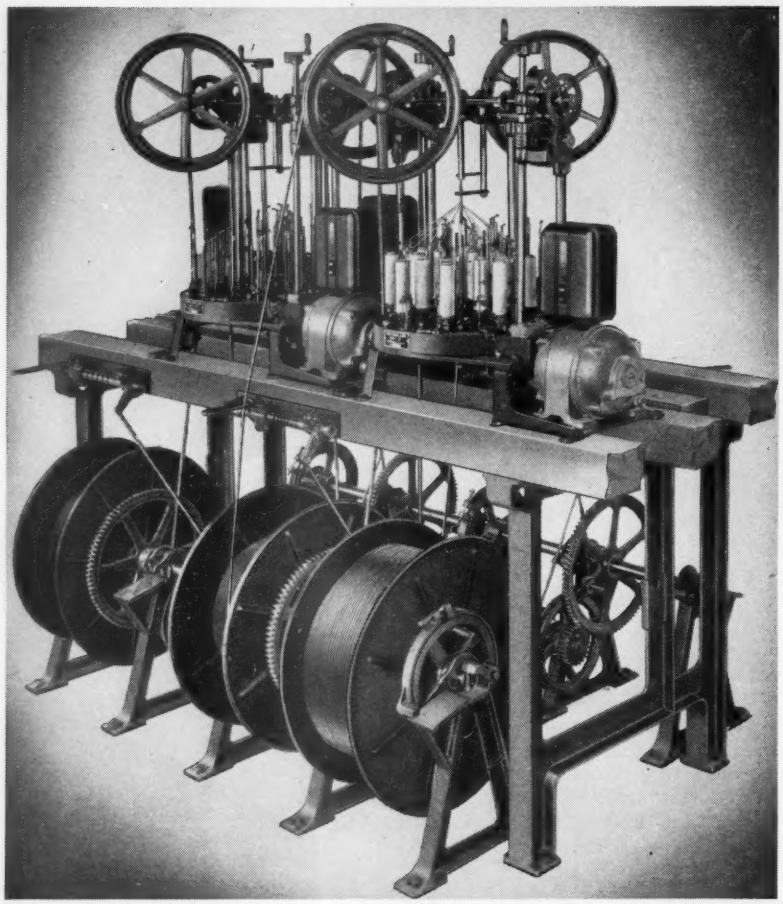
Precision

FINE STEEL AND ALLOY WIRE

Spencer Wire Company
WEST BROOKFIELD PLANT
WEST BROOKFIELD • MASS.

BRAIDERS
FOR WIRE INSULATION
SIZE B-11

40%
INCREASE IN
YARN
CAPACITY
OVER
B-2 SIZE



INCREASED
OPERATING
... EFFICIENCY

LOW
MAINTENANCE

B-11 BRAIDERS, equipped with high speed spring tension carriers and thick plates, provide the economical means of covering wire.

Whether your problem be that of a single braid covering or a triple covering for weatherproof wire, the B-11 BUTT BRAIDER will prove to be the most efficient solution.

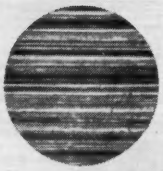
WRITE FOR DETAILED DESCRIPTION

NEW ENGLAND BUTT COMPANY

304 PEARL STREET
PROVIDENCE 7, RHODE ISLAND, U. S. A.

CUPRODINE

FACILITATES DRAWING



A polished steel surface when magnified appears rough — covered with pin points and file-like ridges.

A cross section of these ridges more highly magnified might be illustrated as above.

When Cuprodized, the sharp ridges are dissolved and surface coated with copper insuring longer die life and improved products.

Assures longer die life—less scoring and breaking

CUPRODINE (copper) coatings are unique in that the Cuprodine bath reacts chemically with the steel, dissolving the microscopic surface ridges and points which protrude through most drawing compounds, scratching and ruining the dies.

A chemical reaction causes copper to plate out of the solution (without current), producing a thin tight copper coating that provides an ideal prelubricating surface insuring longer die life-improved drawing.

CUPRODINE is well known and has been generally adopted in wire mills and in the production of small arms steel shell cases. There is a large field in other industries where the economy and efficiency of this new method can be applied. Further information regarding the adaptability of Cuprodine to your particular needs will be furnished by our Technical Laboratories. Write dept. D-3.

MANUFACTURERS OF INHIBITORS AND METAL WORKING CHEMICALS

AMERICAN CHEMICAL PAINT CO.
AMBLER ACP PENNA.

Note—West Coast Plants may address inquiries and orders for prompt delivery to Leon Finch, Ltd., 728 East 59th St., Los Angeles, California.

Need a "Tailor-Made" Drawing Compound?

Whether you draw steel, stainless, copper or any other wire, by wet or dry methods, the need for greater and greater production speed with maintained quality of finish, has probably made you wish that you had a better drawing compound for your work.

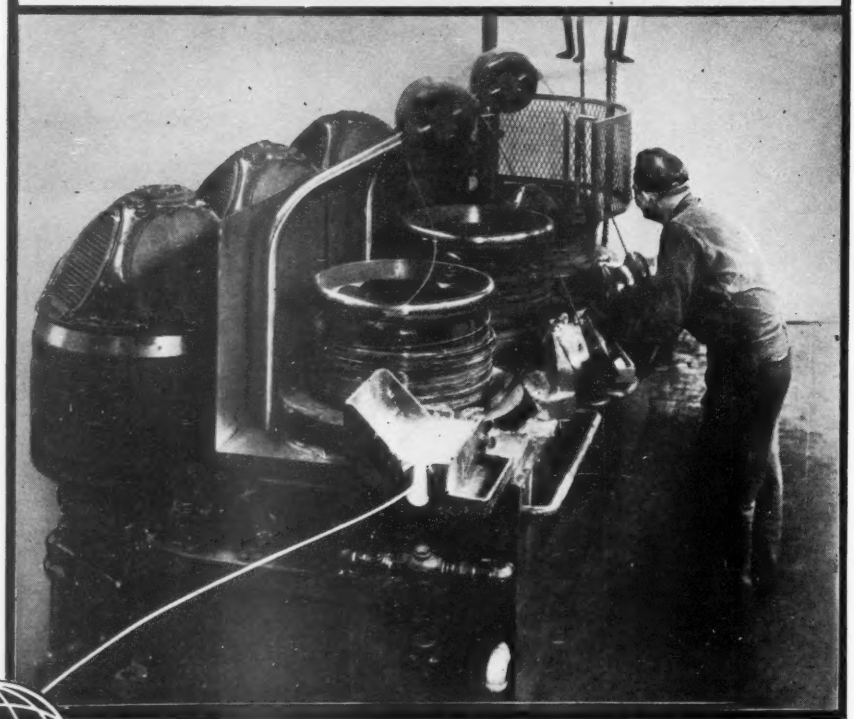
There are so many tough drawing jobs where the lubricants on the market just do not come up to expectations. That is where "tailor-made" comes into the picture. We are ready to work out a satisfactory solution to any of your tough drawing problems, if you'll put them up to us. Our laboratory and long experience in developing special compounds for individual wire drawing operations will give you results.

Of course, the regular Magnus line of wire drawing compounds is made up of time-tested and proven lubricants which meet many a difficult drawing problem.

For Example:

Magnus 52C-1 is an unusually effective lubricant in multi-pass drawing of high carbon steel wire. It gives much greater production speed —carrying through perfectly on seven passes at a rate of 750 feet per minute. As a matter of fact, many mills keep a stock of 52C-1 on hand for use on their toughest drawing problems, not only in high carbon steel, but on stainless and other metals. It will pay you to investigate 52C-1.

Write for a copy of this complete bulletin, covering the Magnus line of wire drawing compounds.



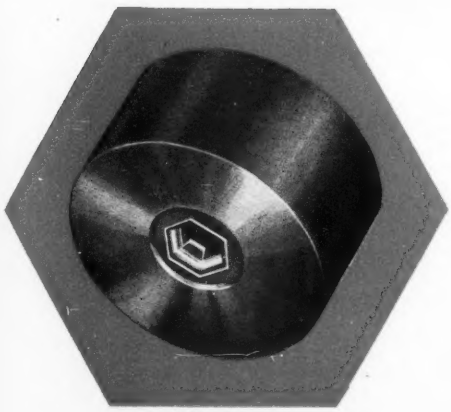
Magnus **MAGNUS CHEMICAL CO.** 188 SOUTH AVENUE, GARWOOD, N. J.

Wire Drawing Compounds

HARTLEY

L E
Y

THE TRADE MARK THAT STANDS FOR *Special* QUALITY and SERVICE ON *Special-Shaped* DIES



EYELET DIES
BOLT HEAD DIES
TUBING DIES

SPECIAL WEAR RESISTANT DIES
EXTRUSION DIES
WIRE DRAWING DIES

No need to worry about facilities for fast and reliable production of special-shaped dies—that's the specialty of the Hartley Wire Die Company.

Skilled workmen combined with extreme manufacturing care and most critical inspection assure you dies of the high quality you require, and the prompt service you desire.

"From blueprint to finished product" — that's Hartley service. Just send us the prints of the dies you require; no problem is too tough, no job too large or small. Every assistance we can give is yours.

MANUFACTURERS, ALSO, OF SHELL DRAWING DIES OF ALL CALIBERS FOR THE AMMUNITION PROGRAM.

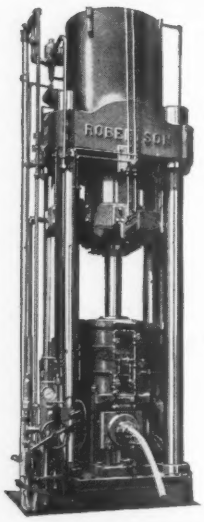
HARTLEY WIRE DIE CO.

L E
Y

MANUFACTURERS OF TUNGSTEN CARBIDE WIRE, TUBE, EYELET AND SPECIAL DIES, MANDRELS AND PUNCHES.

Established 1850 — *Thomaston, Conn.*

It can be done with drums.....



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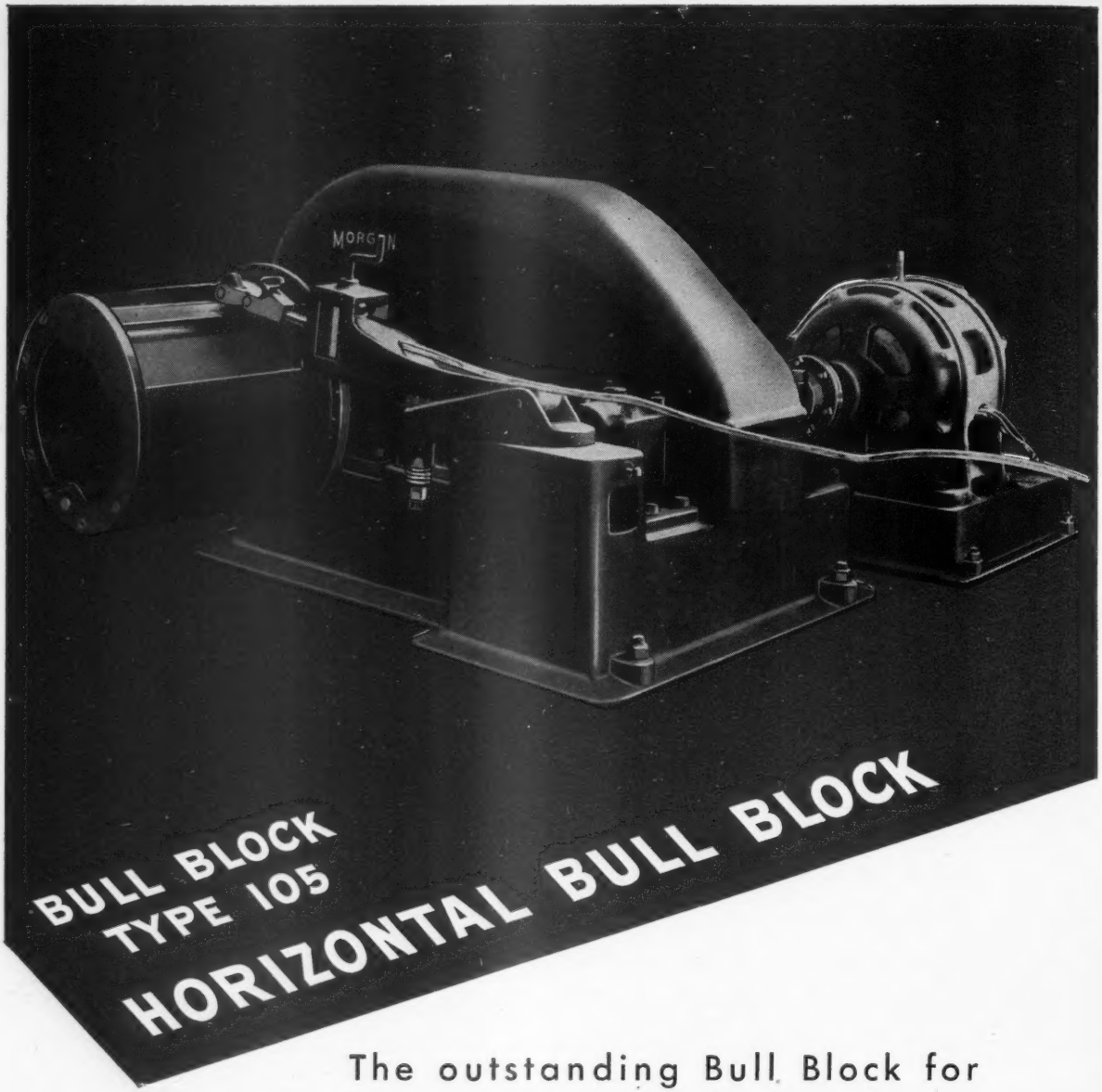

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 20 MARCH, 1945 No. 3

Designated as

Official Publication By The Wire Association

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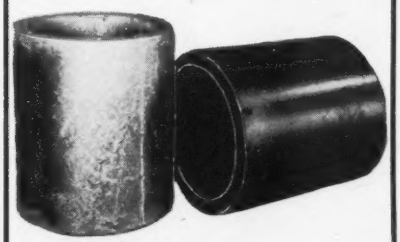

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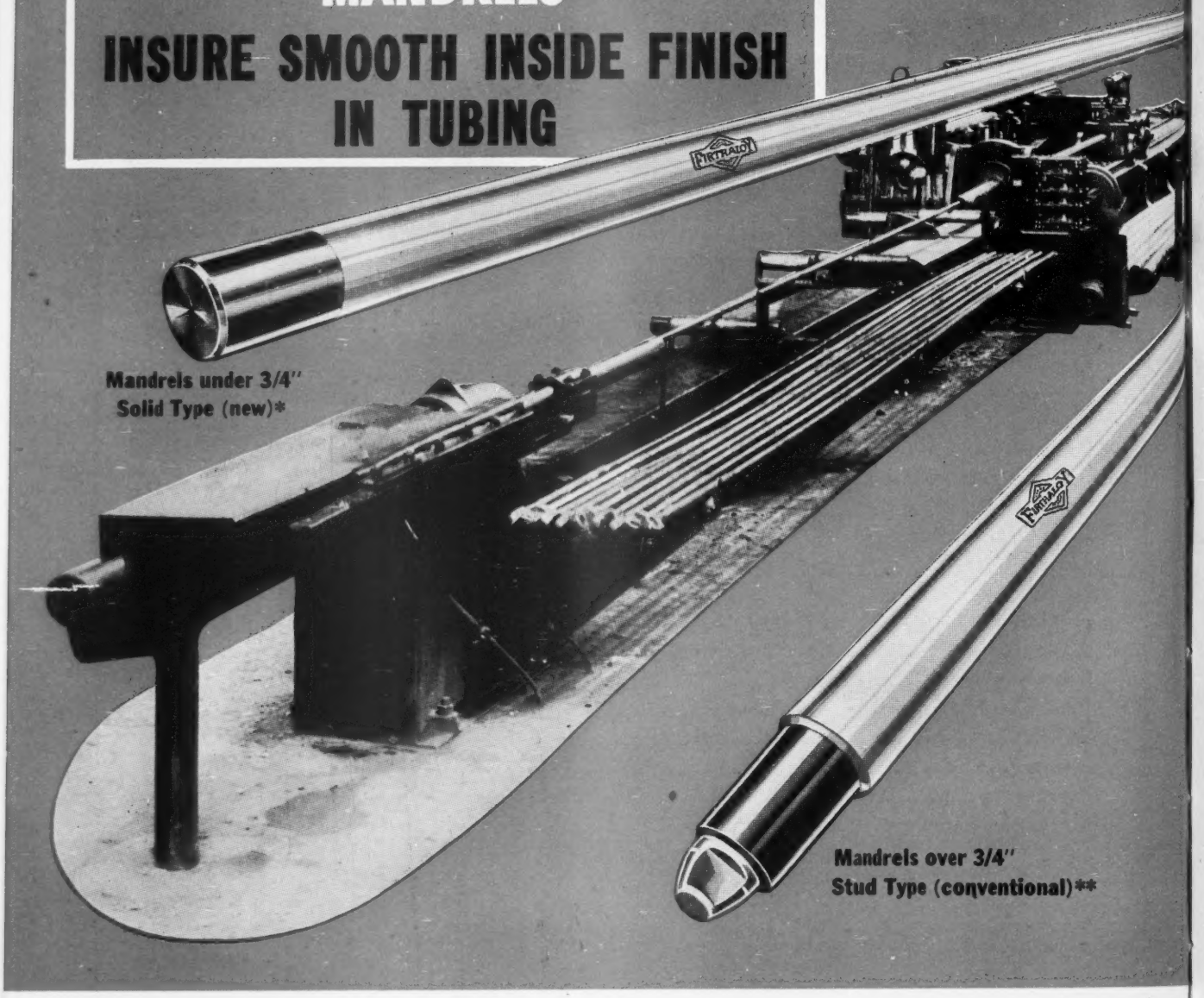

The inside of a tube is as important as the outside. The Tubing Industry is becoming more and more exacting on requirements for internal finish. Therefore, FIRTHALOY Sintered-Carbide Mandrels are in growing demand because they produce smoothest inside finish—resulting in least friction or least resistance to flow of gases, liquids, etc.

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WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip.
Wire Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 20 MARCH, 1945 No. 3

The Manufacture of Air-Craft Instrument Springs

J. W. Rockefeller, Jr.
All-Weather Springs
New York, N. Y.

The problem of making springs for aircraft instruments during the war may be summed up briefly as doing the impossible — in a hurry. It is doubtful whether there is today in the United States, a single spring maker who will concede that anything short of accomplishing perpetual motion is beyond the possibilities of a spring. ✦ ✦

NOT long ago it had been generally recognized by spring makers and engineers that a spring having a ratio of coil diameter to wire diameter of 11 could not be coiled with an initial tension greater than 11,000 p.s.i. Some spring charts constructed by less conservative engineers in our industry indicated that this figure might be doubled, but that such high stress under initial tension should be avoided in design if possible. Early during the War, the design of an urgently required instrument spring having this large D/d ratio called for an initial tension of 60,000 p.s.i.—and this was not all. Better than average creep properties were required, and exacting load deflection requirements specified. Of course, no standard coiling machine would coil such a spring, but by special coiling means, an initial stress of 70,000 p.s.i. was coiled into these springs, a heat treatment applied which relieved about 10,000 p.s.i. initial tension, as well as improving the creep properties, and springs meeting requirements were delivered within two weeks of receiving the order. To make the story complete it must be added that the scrap pile exceeded in magnitude the volume of usable springs, and that this same pile included some pretty funny looking specimens of the art of wire forming. However, in all, 40,000 of these springs were delivered and satisfactorily employed in instruments.

FIGURE I.
Detailed testing is frequently required in instrument springs. Specifications frequently call for a load at a spring length to be held within 2%. When such specifications are set forth, every spring is tested to make sure it falls within tolerances.

✦ ✦ ✦

MUSIC wire, because of its high elastic limit and ultimate strength, has been used frequently in the manufacture of instrument springs. In spite of its advantages as a spring material in its final form, music wire possesses some properties which have in all likelihood, kept more than one spring maker awake nights. There will be slight variations in this wire, not only from coil to coil, but even in a single coil, which will account for small variations in spring back. That is to say, if the wire is wound on a mandril of a given size, under a controlled tension the coil will spring back when released, to a diameter considerably larger than that of the coil under tension. The amount of spring back will depend largely on the hardness of the wire and in a spring with an outside diameter of one inch coiled of .050 music wire, the variation

Designated as Official Publication by The Wire Association

in the outside diameter of the finished coil may be considerable. In some applications in which music wire is used tolerances on outside diameter are held fairly close so that the springs cannot be shipped as they come from the machine. The spring maker has found that he possesses an "ace in the hole" in this regard, however. A heat treatment will invariably improve the properties of music wire after it is formed and will also tend to shrink the coil diameter. By sorting springs after they are formed and subjecting them to varying degrees of heat treatment, the outside diameter can be held within very close tolerances, even where the hardness of the wire used, shows more than average variations.

✦ ✦ ✦

THE spring back in pre-tempered wire may also prevent performing certain operations completely by mechanical means. In the case of an extension instrument spring of music wire, the ends had to be turned out and held concentric with the coil within .005 inches. Due to the variation in spring back it was necessary to perform this turning operation by hand, accompanying it with visual inspection means which checked the concentricity of the end in both planes.

✦ ✦ ✦

DUE to the urgency with which they were required and in some cases to the small quantity as well, springs which would ordinarily have been made in large quantities on a four-slide machine had to be made with quickly improvised tools on a kick press. Occasionally, several operations were required, but frequently a few thousand springs could be turned out and in a fraction of the time required for making the tools only for a four-slide job.

✦ ✦ ✦

Thermally Self-Compensating Springs

ONE lesson which has been learned by about everyone connected with aircraft during the War, is that practically all materials are subject to sometimes surprising behavior at high altitudes, where the temperature drops far below anything normally experienced at sea level.

TABLE 1—PERCENT CHANGE IN STIFFNESS FOR 1° F. CHANGE IN TEMPERATURE

Spring Material	Hardened or Cold Drawn	Annealed
High Carbon Steel	0.014	0.011
Piano Wire	0.015	0.012
5% Nickel Steel	0.016	0.014
Chrome-vanadium Steel	0.015	0.014
18-8 Stainless Steel	0.024	0.022
Monel Metal	0.016	0.016
Nickel Silver	0.019	0.018
Beryllium Copper	0.019	....
Phosphor Bronze	0.021	....
Brass	0.022	....
Elinvar	0.004	....

Springs in aircraft instruments should operate satisfactorily at temperatures ranging from −50°F. to +150°F. It has long been known that metal springs are affected by temperature changes. In common with all other metal members they undergo dimensional changes, but more important in most applications, is the effect of temperature on their elasticity. Table one shows the effect on elasticity of 200°F. temperature change on some spring materials in percentage of their deflection. Dimension changes in a spring may be responsible for what is generally called the zero error in an instrument: that is, the shift of the pointer from zero at no load. The spring's dimensional change is usually greater than the dimensional change in other parts of the instrument, which otherwise might compensate for it. In addition to this dimensional change, producing the zero error, the change in elasticity in the spring, produces a scale error. That is, the steel spring which stretches one inch under one pound at 50°F. will stretch 1.015 inches, under 1 pound at 150°F. This effect of thermal co-efficient of modulus of spring materials has been known for many years and in scale and other instrument construction, means have been employed to compensate for it, such means usually correcting about 90% of the error. More recently spring metals of the elinvar type have been developed, which permitted the elimination of some of the earlier temperature compensating arrangements. These metals in general give about as good results as the temperature compensating devices which they replaced. However, they are so critical that the slightest change in composition or heat treatment produces a change in the thermal-elastic properties. While they operate satisfactorily enough for most purposes over a range of 75°F., they are not, in most cases, ideally suited to the range in which aircraft instruments are used. A considerably finer degree of accuracy has been obtained by employing springs made of two sections, one over-correcting, and the other under-correcting, and matched in such proportions as to give the degree of thermal self-compensating desired. (U.S. Patent #2,236,158)

FIGURE II.
On small lots of springs required urgently, the kick press frequently takes the place of a four-slide machine. A few thousand springs can be made in this manner long before tools could be made for making these springs on a four-slide machine.

✦ ✦ ✦

THE production of an elinvar type metal is but the first step in these thermally self-compensating springs. Two elinvar type metals are selected for the spring's fabrication, one having a small negative value and the other a small positive value of thermal co-efficient of elastic modulus. This co-efficient is determined on

heat treated spring sections so that any change thus produced is accounted for in the design calculations. Once the final thermal co-efficient of both spring sections is determined, their combination in the correct ratio will produce a zero co-efficient or any desired positive or negative co-efficient in the final combusion.

✦ ✦ ✦

IT is only in infrequent cases that a zero thermal co-efficient of elastic modulus is actually desired. Wherever the instrument contains some other elastic element in addition to the spring, such as a bellows or Bourdan tube, the elasticity of such an element will also be affected by temperature and contribute to the temperature error in the instrument. Where the spring's motion is multiplied through a rack and pinion, the effect of a rising temperature is to increase the length of the rack, thereby, requiring a greater rack movement for the same angular displacement of the pinion and pointer. A bronze rack, for example, will have a thermal co-efficient of expansion of about $+11\times10^{-6}$ per °F. If a spring used in connection with this rack is perfectly self-compensating for temperature, the effect of temperature change on the rack will produce an error in the instrument. In order to eliminate this error, the spring should have a slightly negative co-efficient, that is, if the thermal co-efficient of elasticity of the spring is made -11×10^{-6}, it will just off-set the expansion and contraction of the bronze rack. In order to produce the ideal spring, for any instrument, it is necessary that the spring designer have complete knowledge of the instrument itself and of the effect of temperature on its several working parts. Springs may in this manner be held to a thermal accuracy of .02% without difficulty.

✦ ✦ ✦

Hysteresis and Creep in Instrument Springs

TWO additional sources of error found in the average mechanical spring are hysteresis and creep. The first of these terms is used to describe the failure of the unloading curve of the spring to coincide with the loading curve, the area enclosed by the two curves being referred to as the hysteresis loop. Ordinarily this loop is small. In music wire stressed at 40,000 p.s.i. before heat treatment, measurements of this loop have shown the hysteresis to be 3% of the measured deflection. Heat treatment of a tempered spring material to improve the hysteresis properties after spring is coiled, will reduce the hysteresis 50%. The selection of the proper material can also result in a very much smaller hysteresis loop. In springs for aircraft instruments it is frequently necessary to hold the hysteresis to within .02% of the total deflection, since every .01% may produce an error of 5 ft. in altimeter reading. With a bomb released from a plane flying at

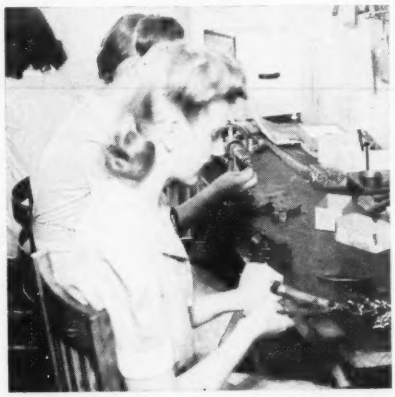

FIGURE III.
Due to the variation in spring back in music wire, it is often necessary to do some of the forming operations by hand, particularly where close tolerances must be met. The springs are inspected for concentricity of ends as they are made.

400 miles per hour a few feet error in altitude may make a considerable error in bombing precision and it is important that in springs used for this purpose, all errors be reduced to a minimum.

✦ ✦ ✦

"CREEP" in a spring or the continued deflection under static load introduces an error similar to that occasioned by the hysteresis effect. In many applications creep in springs is most troublesome at high temperatures, that is, in the range from 300°F. to 650°F., since at these temperatures the rate of creep is greatly increased. However, even at temperatures from −50°F. to+150° F., creep in instrument springs can produce a serious error in the instrument itself. At elevated temperatures, special alloys can be used which under the proper heat treatment, exhibit a minimum creep. Such alloys include, inconel, "K" monel metal, "z" nickel and stainless steel. The best stress relief treatment for these metals appears to be an exposure for ½ hr. to a temperature of 800° to 900°F. At moderately high temperatures, such pre-tempered material as music wire seems to give the best results with a stress relief treatment of 800°F. As applied, however, at lower operating temperatures, in some cases at least, lower stress relief temperatures, namely one in the neighborhood of 600°F. seems to give considerably better results. Such a stress relief treatment applied to music wire springs stress at 40,000 p.s.i., operating at a temperature of 70°F., reduced creep 90%. In order to compare the creep properties of pre-tempered wire and the wire springs which had been quenched and drawn after forming, room temperature tests were run upon music wire springs which had been stress-relieved for 10 minutes at 610° F. and springs of the identical wire which had quenched in oil and subsequently drawn at 450°F. The pre-tempered wire, stress-relieved, showed in 21 hours, a creep of .071 inch against .072 for the quenched and tempered springs. In order to determine the effect of heat treatment on the recovery rate of a spring, the music wire springs which had undergone the 21 hour creep test were again stress-relieved at 300°F. for 10 minutes and reloaded. After 21 hours the creep in these springs measured the same as on the original test indicating that whatever changes a spring undergoes during creep may be eliminated by short time exposure to relatively low temperature.

✦ ✦ ✦

IN the case of beryllium copper somewhat higher stress relief temperature in the neighborhood of 700° F. is ordinarily employed. A slight change in the composition of the spring material may produce a considerable improvement in its creep properties. For example, ordinary commercial variety beryllium copper spring wire, stressed at 44,000 lbs. p.s.i. exhibits a creep in the neighborhood of .3% in 100 hrs. A slight

(Please turn to page 210)

THE BEST SPRINGS
ARE MADE OF

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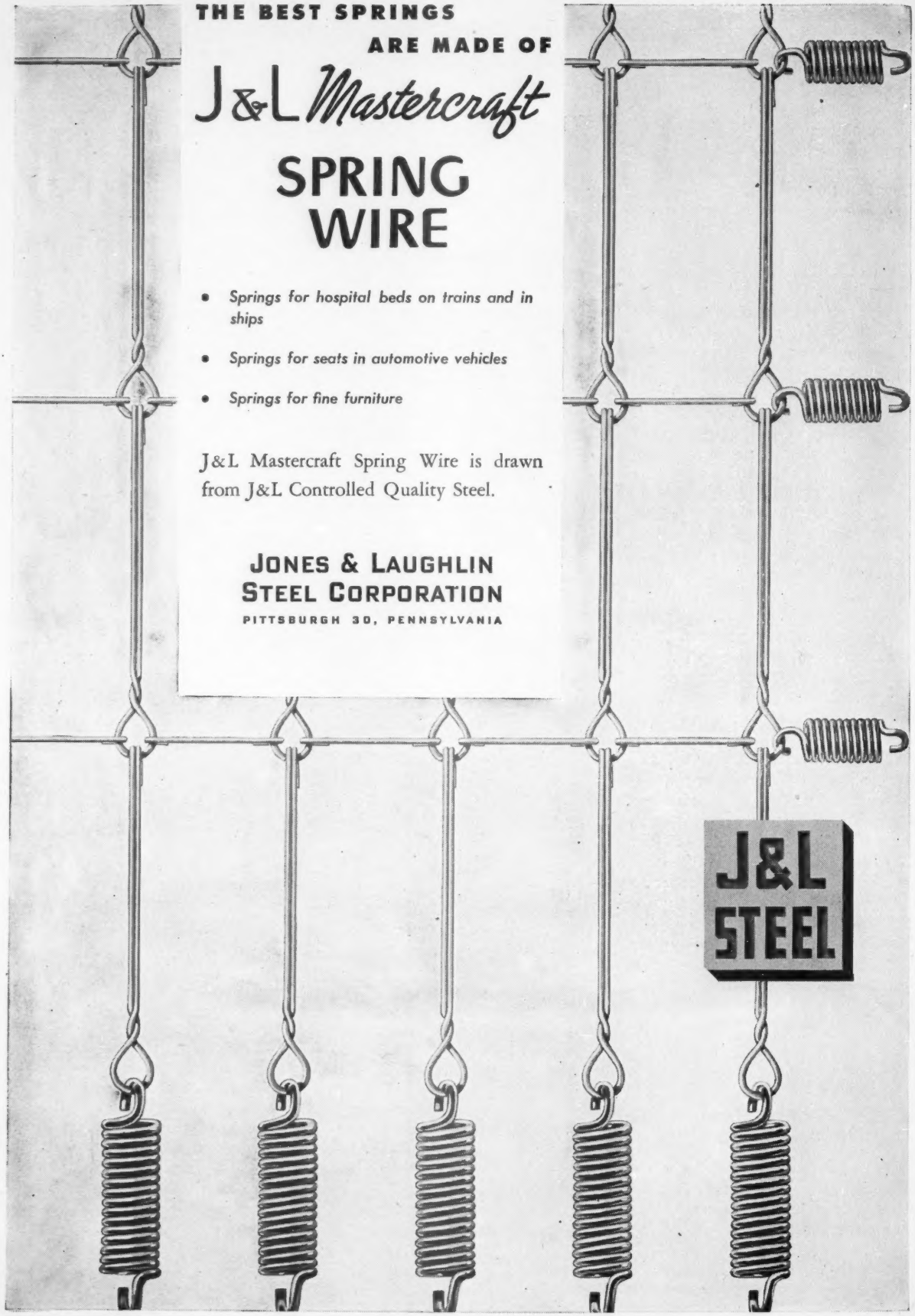


Further Comments on Scotland's Wire Practices

By A. P. Newhall,
M. I. Mech. E.,
Managing Director, Speedwell Wire Co., Ltd.,
Coatbridge, Scotland.

The following data was received in the form of a letter to the editors. The notes published in our April, 1944, issue, starting on page 259, headed "Wire Drawing in Scotland," gave rise to these further comments, which the writers think will clarify the situation, at least with respect to their mills, which they believe are typical of Scotland.

IN my youth I learnt a precept that one should be in the world but not of it and I imagine my present position in the wire industry is illustrated by that saying. So far as I am concerned, I have been drawing wire for many years but I have always consumed everything that we produced and so have never really been in the trade at all. What has brought all this about is an article which appeared in your April number by a correspondent who gave a description of what purported to be the condition of the wire industry in Scotland. It will be seen that while I am very much interested in wire drawing that it is no business of mine to take up the challenge as to what the general state of affairs in our country is, but it would appear that your correspondent had forgotten our national motto which is "Nemo me impune lacessit," which freely translated means, "Touch me if you dare." It is my good fortune to have among my friends a number of people in the wire industry in Scotland and from what I know of them, they are quite capable of speaking for themselves, and I certainly regard them in a very different category from that in which they are placed by the writer of your article.

✦ ✦ ✦

DURING this time I have developed quite a lot of ideas that affect the wire industry and I would like to tell you something of these. In particular, I have done a great deal in connection with the swaging of wire and have developed what amounts to a new industry in this country. All this comprises an up-to-date plant as you will gather that you cannot do things of this kind without modern equipment.

WHILE we are doing our swaging on what is a standard type of rotary swaging machine such as has existed in America for more than thirty years, we have adapted to these machines, arrangements of one kind and another, so that we can make studs by an intermittent swaging process and can hold very close limits both in diameter and length. Most of the work we are doing is in fairly high tensile, that is to say, round about 160,000 p.s.i., with very high ductility. I gather from my correspondence with my many friends in the United States that there is now a considerable development in roll threading on your side of the Atlantic and there also is here. We are working with the type of machine which is operated with cylindrical dies and hydraulic pressure. The machine is, I believe, quite well known in America but whether it is as good as the types which are now being developed in the United States, I am not in a position to say. At any rate, it makes a perfect thread and can be held to the closest possible limits —Class IV fits are quite easily obtained, despite the fact that the threads are rolled in the heat treated condition.

✦ ✦ ✦

IT seems to me that at this stage it would be proper that I should give some kind of view of our plant. We have worked successfully with an acid tank which was developed here and made by ourselves. It consists of a re-inforced concrete casing with a tellurium lead lining which is burnt to form a complete casing. The inside of the tank consists of 'blue' brick which is a native product and is very suitable for the purpose. It is cemented with 'Produrite' which is, I believe, a trade name of the firm who supply it to us and which is certainly a very suitable cement for resisting acids. These tanks have been up for more than a dozen years in which time there has been no necessity for repair, so that it will be apparent that they are satisfactory.

✦ ✦ ✦

WE use a sulphuric acid of about 6% strength and heated to about 180° Fahrenheit. After the acid bath, we drop the coiled rods into a large tank filled nearly to the brim with cold water and thereafter we hose it at about 350 lbs. pressure. In our lime tank we use lime in the de-hydrated form. This gives a very effective coating preparatory to drawing. I might here mention that our Morrison Flash Baker was the first, so far as I know, introduced into Europe and has been in constant use for over a long period of years to our entire satisfaction.

✦ ✦ ✦

OUR drawing is done both on American **(Vaughn)** and British blocks and the capacity goes up from less than ¼" to 1" diameter. All our dies are of tungsten carbide and originally were procured entirely from the United States 'though we are now able to buy quite satisfactory dies in this country, but we still continue to procure a certain

number from some of your best known makers in America.

✦ ✦ ✦

STRAIGHTENING is done on both British and American machines, the latter including **Schuster** and **Hallden.** The Hallden can straighten and cut off both a hexagon and round in 25′ lengths up to ¾″ diameter. We have recently introduced a new type of block for drawing up to 1″ which was made by Marshall Richards, who are well known to your readers. One of the features about this is that it has a Laurence Scott A. C. variable speed motor. I have only just seen this block and never in operation, but it certainly is a workmanlike job and I believe will turn out quite satisfactorily. This type of motor, so far as I know, has never been applied to a block of this size or whether indeed, has been applied to draw blocks, I am not quite sure, but anyhow, it is an experiment in which I am very much interested and I will be happy later, to pass you on my views about it when I have more opportunity to speak with knowledge.

✦ ✦ ✦

OUR wire is used almost entirely in connection with our bolt and stud making plant. We have a large battery of **National** boltmakers and have also other types of cold upsetters. We have also a considerable battery of **Budd Ranney** machines, on which we cut off nut blanks.

✦ ✦ ✦

AS many of your readers know, I have been visiting the United States regularly for about thirty years and I am probably more familiar with the plants on your side than I am with those in this country, but I am quite satisfied that the standard of efficiency in a Scottish factory is quite equal to that of the most modern plants in America. This is not a boastful statement because practically the whole of the plant in this factory or at any rate, a great proportion of it, originated in the United States. For example, in our machine shop we have a large battery of No. 2.G. **Brown & Sharpe** machines which are mostly used for second operation work. We have Tapping machines of the precision type made by **National Machinery Co.,** at Tiffin and by the **Waterbury Farrel Co.,** at Waterbury. We have also a good many Drilling machines and quite a large battery of **Warner & Swassey, Gisholts,** and other types of capstans. These run in sizes from No. 2's to No. 4's. Our Tool Room equipment includes practically all the standard machines, such as **Brown & Sharpe** Universal Millers and Grinders, **Hendey, Pratt & Whitney** and **Southbent** lathes, Heald internal grinders, and also a very fine type of English built thread grinder made by **The Coventry Gauge & Tool Co.,** who are certainly a very up-to-date concern in this direction. Our Inspection department is 280 ft. long and in it we have eight motorized **Rockwells, Electrolimits** and every other type of gauge necessary for checking to the finest limits and also the **Fels-Johnson** crack detector which we use extensively. In our Laboratory we have a complete equipment of testing machines, including a **Denison** 50 ton tensile testing machine with the **Lindley and Ewing** extensometers. We have a **Vickers** photographic microscope with a capacity of 2,000 magnifications and a **Zeiss** projector with 30 magnifications, which is used for checking threads. We use the **Vickers** hardness testing machine as well as **Rockwell** and **Brinel.** These are distinct from those mentioned in our Inspection department. We have the **Avery** type of Impact tester by the Izod method and the **Hounsfield** tensometer which we find most useful indeed for our class of work. I know another thing that will be of interest to you is an induction hardening plant in which we employ a 180 h.p. motor with a 100 K.W. generator running at 9,600 cycles. We do a good deal of our hot forging by means of electric heating. The best form so far we have found is a type where you place the piece against the anvil by a pneumatic pressure of about 30 lbs. 'though we have recently developed another type where the heating is done in the centre and the part is cut into two before forging.

✦ ✦ ✦

I hope I am not exceeding my welcome in sending you so much detail but I felt that as you had to have a picture of a Scottish factory run on modern lines, it would be very difficult to do so without going into some considerable amount of detail.

✦ ✦ ✦

INCIDENTALLY, I would not like to omit the mention of my old friend, **Charles Pellow's** machine, which we use for slotting nuts and which we have found most useful. In fact, we have run out of our original ones with much wear and have now installed some of a completely modern type, but of course, made in Detroit.

✦ ✦ ✦

A great deal of our production milling is done on the **Cincinnati** machines and we have a considerable battery of centre-less grinders. We have also centre-less grinding equipment in our drawing shop for bars.

✦ ✦ ✦

UP to the present time, we have got as high as 1″ diameter with the cold swaging at 160,000 p.s.i. so that you will see that our development in that direction is considerable.

✦ ✦ ✦

Wire Drawing in Scotland

by W. S. Black,
Joint Managing Director,
Speedwell Wire Work, Speedwell Wire Co., Ltd.
Coatbridge, Scotland

I have read with interest the letter on the above subject contained in your April issue and feel that our experiences as the newest and now one of the largest Wiredrawers in Scotland might interest your readers and perhaps present a rather more accurate and up-to-date picture of Scotland's progress in wire drawing.

✦ ✦ ✦

OUR parent Company, which started to operate in 1933, manufactures Wire Rope, and in 1937 they sponsored a wire-drawing Company to ensure adequate supplies of satisfactory Roping Wire. **Speedwell Wire Company** was therefore formed with the primary object of meeting the Rope Works requirements, the intention being to expand the output as outside business was developed. A technical Director and Works Manager were obtained and

ideal buildings purchased, and it was decided to install only what was believed to be the latest available continuous machines and tungsten carbide dies throughout. As Roping wiredrawing was an entirely new industry to the West of Scotland, we will pass gracefully over the first few months when the raw labor was being trained and the teething troubles overcome. Today we believe that we are very definitely amongst the really up-to-the-minute and most efficient Roping Wire Manufacturers and in a position to compete successfully with anybody so far as quality and economical manufacture are concerned.

✦ ✦ ✦

OUR continuous wiredrawing machines are mostly of English make although we have altered them considerably, embodying quite a number of our own ideas, and we have had one or two machines built locally. Heavy patenting is coal fired (step grate semi-producer type) and small patenting is gas fired radiant tube. Our galvanizing plants (hot dip) have been built by our engineers and extremely satisfactory results have been obtained with continuously patented, cleaned and galvanized material. The cleaning house is more or less straightforward — Hydrochloric Acid, high pressure hose coupled to our water bore pumping apparatus, hot liming and circulating hot air baking oven (capacity about 4 tons, 20/30 minute cycle).

✦ ✦ ✦

OUR die room plant is of English and our own make with one American made lapping machine. It is mostly operated by girls working under a "Speedwell-trained" superintendent who is encouraged to roam the mill studying conditions and results and to make experiments regarding angles, shapes, etc. We also case the pellets, pierce, shape and finish the dies. Records of die life are still kept, each die being card-indexed, but nowadays dies give so little trouble and tonnages are so good that this is almost unnecessary.

✦ ✦ ✦

WE cover more or less the whole range of sizes, qualities and finishes required for rope-making to .0084" from dead soft to 180 tons per square inch, and although the primary object was to supply the parent Company we are now supplying wire to more than half the independent Wire Ropemakers in Britain, with the result that the parent Company is required to buy quite a considerable proportion of its requirements from outside sources due to the very heavy demands on Speedwell Wire Company in spite of a very big expansion in output.

✦ ✦ ✦

WE are not in the least hush-hush about our works and have shown many wiredrawers around our plant and have in most cases been shown around their in return. It appears that the War has broken down a lot of the old policy of jealously guarded "secrets"—"secrets" which only too often prove to be quite ridiculous.

✦ ✦ ✦

IN general we feel rather proud of our achievements, and it is not unnatural that we cannot altogether agree with your correspondent that "Wiredrawing in Scotland is at a pretty low ebb," and the writer would like to extend to him, through your columns, a hearty invitation to visit Coatbridge, when we would be delighted to show him around our plant and let him see at first hand something of wiredrawing activities in Scotland, provided, of course, that he will disclose his identity and subject to security restrictions. Perhaps after his visit he may like to write a second report covering "The Future of Wiredrawing in Scotland."

DIRECTORS' LUNCHEON

Waldorf-Astoria Hotel, New York, N. Y.

One O'Clock, March 23, 1945

The Directors of the Wire Association will hold their annual meeting on March 23rd, following which there will be a reception at 12 noon and the annual luncheon at 1 p.m. A timely program has been provided, which we feel sure will be interesting.

Members of the Wire Association are invited to attend to meet the officers and directors. However, under the restrictions of the O.D.T. regarding meetings, the attendance will be limited to the first fifty (50) reservations received.

IF YOU CAN COME PLEASE BE SURE TO SEND US YOUR RESERVATION PROMPTLY. THE COST OF THE LUNCHEON WILL BE $4.00 PER PERSON.

Make reservations immediately to

RICHARD E. BROWN, Executive Secretary

THE WIRE ASSOCIATION

300 MAIN STREET STAMFORD, CONN.

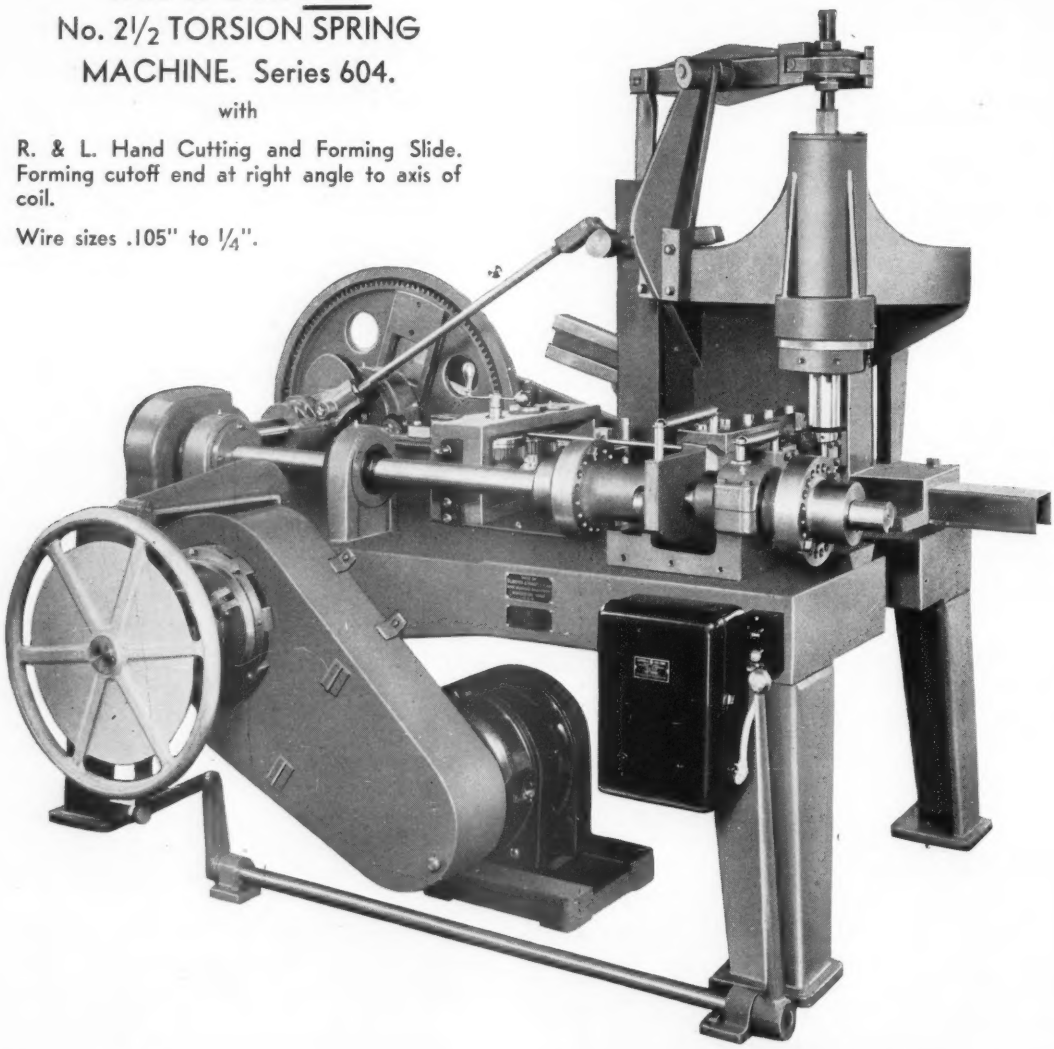
Spring THINKING?

THIS IS OUR *NEW*
No. 2½ TORSION SPRING
MACHINE. Series 604.

with

R. & L. Hand Cutting and Forming Slide. Forming cutoff end at right angle to axis of coil.

Wire sizes .105" to ¼".



"THE MACHINES THAT PUT THE 'RINGS' IN SPRINGS"

Designers and Builders

Sleeper & Hartley, Inc.
Worcester, Massachusetts

Destructive Effect of High Temperature Solders on Copper Wire

By R H. Bailey
Fairchild Camera & Instrument Corp.
New York, N. Y.

PROOF that commonly used high temperature molten solders have destructive effect on copper wire has been discovered by engineers of the Fairchild Camera & Instrument Corporation, N. Y.

✦ ✦ ✦

WHILE conducting tests that resulted in the finding of a new method for clean-stripping Formex type insulation from fine wire (sizes #36-44). Fairchild engineers explored this interesting phenomenon, and have worked out a preventative. Since its existence may not be generally known, this destructive effect and the remedy should be of particular interest to engineers and production men in the electrical, radio and electronics fields.

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THE Fairchild tests with small diameter copper wires show the need of rigid temperature control, and, to a lesser degree, close attention to solder composition, in the hot tin dip method of tinning or soldering wires. The life of fine wire, dipped in any solder, is lessened with increasing solder temperature. Low temperature solders, from the melting or liquid point to 600 degrees (Fahrenheit), should be used for tinning and making joints on wire sizes finer than approximately #34 (.0063-inch diameter).

✦ ✦ ✦

CONCLUSIONS reached indicate high solder temperatures are more destructive to wire if the tin content of the solder is too high. This destructive effect also increases as the wire diameter becomes finer. By proper control and by proper clean-stripping—in case of insulated wires, synthetic or otherwise—this danger can be avoided. Tests reveal positively that life of a given wire is greater if lead content of the solder, for any temperature, is higher.

✦ ✦ ✦

HITHERTO, one of the most widely used methods of stripping and tinning Formex-insulated wire has required that the wire be dipped into molten solder held at about 1025-1100°F. This is commonly known as the "hot dip solder method," and is a single-step operation for both stripping and tinning such coated wire. Although an efficient method, it has a major drawback in that high temperatures are required for proper removal of synthetic insulation.

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IN this method, laboratory tests show two effects:

1) The wire suffers a reduction in diameter in the stripped and tinned section.

2) Some embrittlement of the wire occurs due to the high temperatures encountered.

✦ ✦ ✦

THE crux of the investigation of the hot dip solder method shows other factors. Synthetic rosin-coated wire must be dipped, above a critical temperature of 932°F., into molten solder. Polyvinal acetal insulation is transformed by the heat, and insulation in this action apparently serves as a flux to permit tinning of the copper wire in the same dipping operation. More positive and complete stripping and tinning are obtained at slightly higher temperatures, approximately 1025-1100°F. For example, in the small wire sizes of #29 H.F. (Heavy Formex) and #40 H.F., the action is completed in about 10 and three seconds, respectively, both at about 1050°F.

✦ ✦ ✧

FURTHER, if the wire is kept in the hot solder long enough, the submerged section is completely eaten away. "Long enough" is an inadequate expression here; for #29 H.F. wire it represents about 20 seconds, and for #40 H.F., 5-6 seconds. The leeway for #29 is relatively appreciable, but not for #40 wire. Heavy Formex will not properly strip and tin below the indicated times, and fine wire suffers by this tight control. Although stripping-tinning action may be held through close control to the minimum time required, some copper loss can be expected. Higher temperatures, up to 1175°F., reduce the minimum dipping times, but also shorten the destruction times. Number 40 H.F. is destroyed practically as the stripping and tinning are completed.

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THIS phenomenon in wire destruction is not alone interesting, it is important and serious. Such reduction in diameter in hot tin dipping means weakened leads, perhaps production losses either at the dipping operation, or later in assembly, and an inferior product that fails in the field; this is especially true in the finer wire sizes of #34-40, or even finer.

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BASED upon these initial observations, detailed tests were conducted by Fairchild engineers. The tests were to determine the time required for complete destruction of copper wire. Three variables had to be considered in these tests:

1) WIRE SIZE — Three wire sizes, #29, 34 and 40, were selected as representative of the more commonly used small and fine wires which would suffer to some degree under this known destructive action.

2) SOLDERS — Three tinning solders, 60 tin/40 lead, 40 tin/60 lead, and 0 tin/100 lead (using pure lead), gave an approximate general working range down to pure lead. This was considered an indicative selection of tinning solders.

INCIDENTALLY, metallurgically, all solders with a melting point below 600-700°F. are defined as "soft" solders. All solders having a melting point of approximately 1100-1200°F. are considered "hard" solders; this includes silver solders. Sometimes, though, silver solder is used; its melting point is about 1200°F. All the tin/lead solders are considered "soft," but 40/60 is often referred to as "soft" solder; 50/50 as "common" solder; 60/40 as "hard" solder. The difference in solder designations, metallurgically, and in the trade, should be borne in mind.

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3) SOLDER TEMPERATURE — For purpose of these tests at Fairchield's, temperature ranges of 550 to 1175°F. were selected. A 600° range represents the lowest reasonable working temperature practical, just above the melting or liquid points of soft solders. It should be noted that 60/40 solder melts and goes into the liquid state at about 400°F., 40/60 solder becomes mushy at its melting point of about 360°F., and goes into the liquid state at about 475°F., and pure lead melts to a liquid at 621°F.

THE 1100°F. group, however, was considered as representing the approximate working range that would be encountered in normal practice for hot tin dip stripping of Formex. In these laboratory tests it was found that Heavy Formex coated wire required minimum temperatures of 1005-1025°F. to be stripped.

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Wire Preparation and Test

ALL test samples of copper wire were stripped in advance of the synthetic insulation. This was essential because, first, the synthetic insulation would not be effected by temperatures below 1000°F.; second, all wire specimens should be in like condition for the consistency of test results. Formex was stripped from the wire samples by the new Fairchild process of stripping Formex coating by dipping the wire in two chemical solutions, leaving test specimens in thoroughly clean and usable condition.

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ALL wire test specimens were bent into a standard hairpin shape with one side bent outward at right angles near the end opposite the loop. The specimens were handled by this projection. They were plunged, loop down, into the molten solder, only deep enough to permit the free side to remain out of the solder to about one-half its length. When this vertical projection fell over, due to the destructive action of the solder, the test specimen was considered destroyed as the wire was so eaten away to be incapable of supporting even this small weight.

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THE wire life or destruction time was measured accurately from the moment of entry into the solder. The solder was kept in a temperature-controlled, electrically-heated cast-iron pot of two cubic inches capacity. Dross was scraped from the solder surface immediately before each test.

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APPROXIMATELY 400 wire samples were tested. All tests have been plotted up in Curves 1, 2

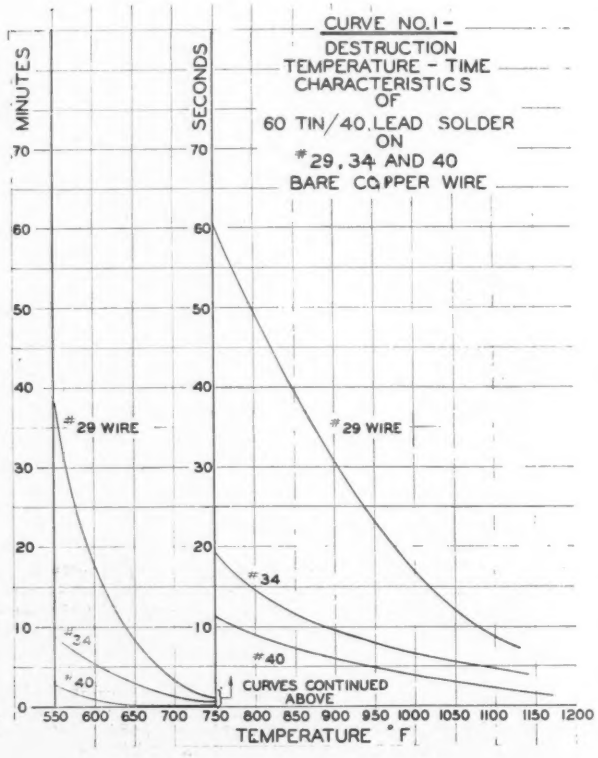

FIGURE I.

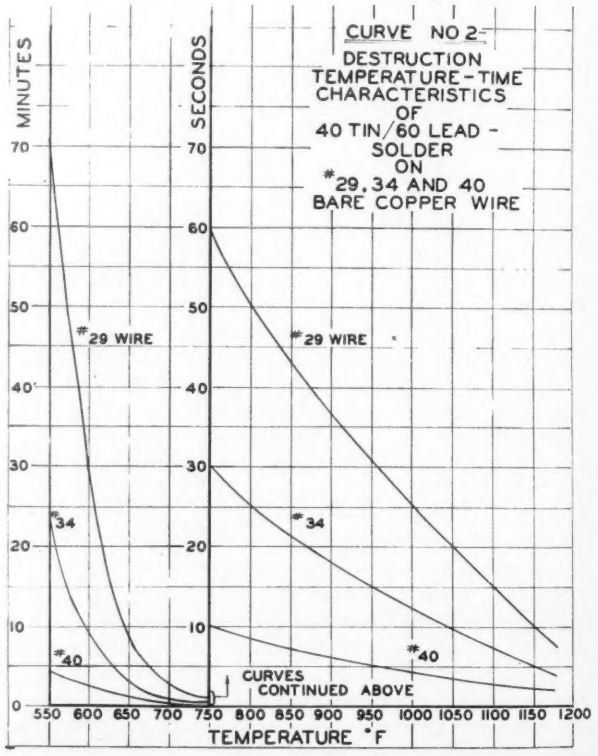
CURVE NO 2 -
DESTRUCTION TEMPERATURE - TIME CHARACTERISTICS OF 40 TIN/60 LEAD - SOLDER ON #29, 34 AND 40 BARE COPPER WIRE
MINUTES
SECONDS
#29 WIRE
#29 WIRE
#34
#34
#40
#40
CURVES CONTINUED ABOVE
TEMPERATURE °F
550 600 650 700 750 800 850 900 950 1000 1050 1100 1150 1200

FIGURE II.

and 3. The curves represent the average values for each test condition. Similar destructive results were observed in using silver solder in a suitable crucible. This test temperature was about 1275 to 1300°F.

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Analysis and Comment

ANALYZING Curves 1, 2 and 3, it is apparent that the greatest rate of change in destruction time with temperature change occurs in the range of approximately 550 to 750° F., for 60/40 and 40/60 solders, and 650 to 950°F. for pure lead. However, this is compensated for by several factors. The time required for tin dipping is short, a matter of seconds, compared with the destruction time, especially at the lower temperatures. The nearer to the melting or liquid point of the solder that this tin dipping is performed, the better, because the above-mentioned time spread is greater. (Incidentally, a pure lead solder joint is not strong mechanically; some tin appears to be beneficial to the bond strength). No attempt was made in the Fairchild investigation to determine an optimum tin/lead ratio.

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ALL curves clearly demonstrate that temperature increase has a tremendously non-beneficial effect upon the destruction time. An unfortunate but important outcome of this analysis is that, for a given set of conditions, wire life decreases materially with decrease in wire size (diameter).

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THIS destruction of the copper is believed to be an alloying away, or driving into, solution of the copper largely by the tin in the solder and to a smaller degree by the lead. Melting points of these three metals are: copper 1981°F., tin 450°F., and lead 621°F. In metallurgy, two metals of different melting points will result in a mixture with a lower melting point than either of the constituent metals possesses alone. Although the melting point of the copper is high, it is believed that the presence of the two other molten metals causes the copper to be dissolved into the tin/lead alloy by this action. In effect, the molten solder is the solvent.

THE second detrimental condition of wire embrittlement at high temperatures has been observed. Photomicrographic analysis of longitudinal sections of untinned and tinned wires shows a surface to subsurface coarsening of the copper crystals in 1050°F. solder dipped wire. This zone does not penetrate to a great depth. Also, a new constituent of possibly a copper-tin alloy is to be found between the solder and copper zones in the 1050°F. wire. This new constituent generally is hard and probably is a contributing factor to fatigue failure of wire. This condition has not been extensively at Fairchild Camera & Instrument, and only in a secondary sense.

✦ ✦ ✦

Conclusions

A review of this data leads to three major conclusions:

1) The life and diameter of any small to fine size copper wire in any solder is decreased with increasing molten solder temperatures.

2) The higher the tin content of tin/lead solder, the shorter is the life of a given wire in that solder for any given solder temperature. Unfortunately, however, an all-lead solder results in a considerably weaker solder joint than tin/lead solders.

3) For a given solder composition and solder temperature, the finer the wire size (diameter) the shorter is the wire life in the solder.

Further conclusions to the tests are:

The all-around best solder of those tested appears to be the 40/60 combination, commonly referred to as soft solder. Other solders in this vicinity may offer even better properties. For certain other purposes, regardless of these findings, hard, or 60/40 solder may be best.

Some form of wire weakening or loss of tensile strength, broadly classified as embrittlement, may be imparted to copper wire from tin/lead solders in the 1000°F. temperature range.

On the basis of these facts only, it is apparent that a low solder temperature shold be used for tinning and/or making joints on wire sizes finer than approximately #30-32. Preferably, these solder temperatures should be kept either within 150° to 200°F. above the melting or liquid point of the solder used, or under 600°F. For Formex or Formvar coated wires, a low temperature insulation stripping method other than the hot tin dip method now becomes necessary. Other methods, involving high temperatures, such as the gas flame method, tend to introduce wire embrittlement and copper oxidation, and are no better.

IN SUMMARY, for the safety of the wire lead being stripped, the production assembly schedule, or the final assembled piece of precision equipment—electrc motor or other appliance—it is important that the fine sizes (#34-46) of synthetic coated wire be stripped, tinned and joined or solder at temperatures at or under 600°F.

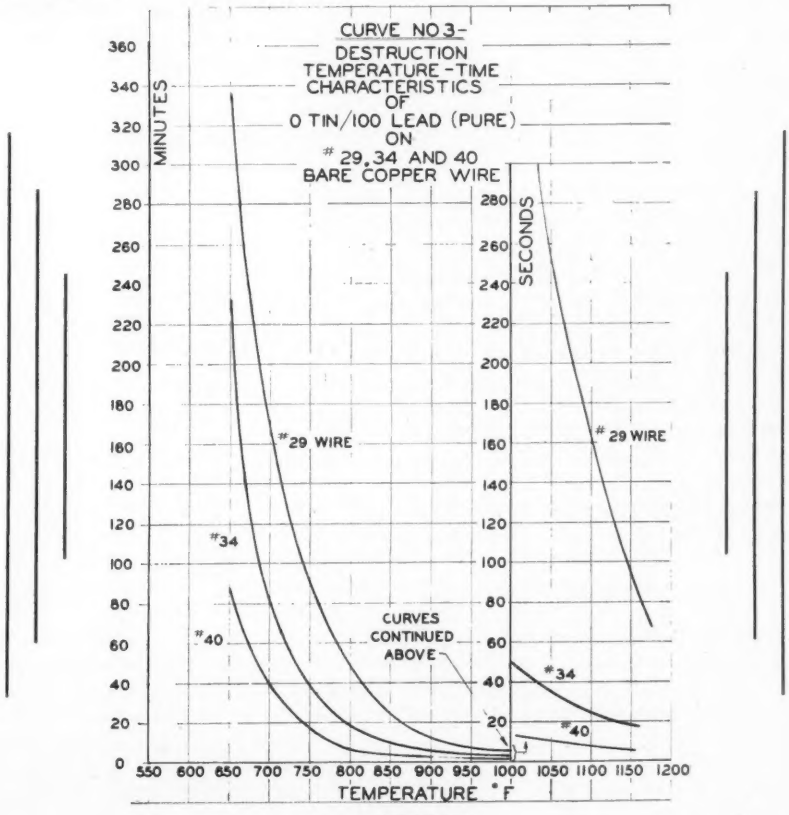

FIGURE III.

The Problem of Post War Employment

By K. Bernard Wise,
West Wickham, Kent, England.

THE demands of the Allied countries at war have provided a great impetus to the development of the technique of wire production and wire application. But to scan through the advertisement pages of this journal will demonstrate to even a casual reader that wire is a commodity which has more than arrived and which means to stay. No disparaging reflection is inferred against the pre-1940 period in so far as the wire industry is concerned but it is patent that the years subsequent have permitted the benefits of wire to become more obvious, more appreciated and put to greater practical purpose. But what of 19?? when the great slaughter has been terminated?

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THE demand for wire as a munition of war will be sensibly reduced, thus involving manufacturers who have played their war time role so well in some degree of embarrassment and, possibly, of hardship. Millions will return from the various fronts seeking re-employment and reinstatement but surely the factories and the workshops will show them a current roster of employees more than sufficient to cope with dwindling demands. That is a most unpleasant academic situation. It may, however, be the practical position as well unless remedial steps are taken to prepare for and combat the ravages of returned mass unemployment.

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IN Great Britain considerable attention has been focussed on the post war unemployment problem, the centre of argument being a report on the situation produced by a committee of experts and issued as The Beveridge Report. This summary provides a plan or scheme for employment for 'all' or 'full employment'. The term 'full employment' does not necessarily infer continuous employment for everyone capable of undertaking a job or filling a situation. In whatever country — and this is particularly applicable to the U. S. A. — a proportion of the employable population is continually in a state of flux, coming and going from one task to another, migrating from one climate to another, those experimenting with a variation in mental and manual occupation and, finally, those whose bread and butter is gained by seasonal working. Unemployment which may be traced back to causes such as these cannot be eliminated but, following pressure and observation, will be finally brought to an irreducible minimum. Consider these employables as a pool of labour or a reserve. Who will refute the claim that a mobile and liquid reserve is other than a formidable asset?

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THE post war unemployment objective will not be aimed so much at the reserve pool but at what may be termed 'Long Term Mass Unemployment'.

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TWICE in comparatively recent years have unemployment figures been caused to dwindle to disappearing point: in 1914/1918 and again following the outbreak of the present world warfare. But who can regard satisfaction in a method of solving a problem through extermination. The Beveridge Report maintains that a satisfactory balance of unemployed would be between 8% and 10%. These figures naturally refer to the British Isles and in the States such a proportion would represent a very high man power total.

A grand forward step would have been taken if unemployment associated with trade cycles is abolished. The cause of trade cycles is food for debate but their effect is remarkably well known. Fundamentally the reason may be said to lie in an insufficiency of spending on the part of the purchasing public. More goods are produced and available than John Doe will remove from the counters in the stores. That position is capable of two way attack: on the one hand subsidizing industries by the State may bring about increased consumer purchases. The alternative appears to be in the arrangement of greater investment so that investment and savings proceed along parallel lines with the former proving able to absorb everything. Naturally the return on invested money will be of considerable influence. If manufacturing gives the appearance of declining, the State should be ready with a cheap money policy even if such a policy has inherent unsatisfactory aspects. The main point about such a scheme would be the importance of its correct timing for once industry is depressed, manufacturers will be loth to borrow at the cheapest rates even if assured by propaganda that the bottom of the depression has been reached. No one in industry will fall for a temptation which he feels may be throwing good money after bad. For that reason alone the cheap money policy needs to be brought in at the first sign of manufacturing market becoming unstable.

✦ ✦ ✦

INFLUENCE on activities can also be brought to bear by the availability of credit facilities. With a booming activity credit should be granted more freely than when a de-

clining activity requires encouragement.

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IT being admitted that unemployment must be determined by the then existing degree of manufacturing activity, it behooves the Governments of the day to lend their weights to determining how best they can serve industry. Monetary policy has been dealt with in an extremely brief fashion in the preceding paragraphs, but side by side with a regulated money policy should go a regulated and rational budgetary policy. Taxation, for example, can and could be so arranged that it assists rather than retards activity. When times are hard, general standing charges tend to increase, heavier commitments must be met from taxation income and higher rates will customarily ensue in such a manner that the disastrous effects of a slump period become magnified, whereas a policy to aid industry in such periods by adjustable taxation would certainly turn the balance the other way.

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EVERY manufacturer will agree that taxation allowances bear a very important part in the determination of his particular line of action. For instance, consider the allowance for depreciation. Admittedly, these allowances may tend to even out over a period of years but why not organize their application and introduce a more marked degree of elasticity? At the height of a boom allowances for depreciation etc. might well be reduced if not almost eliminated whilst, at the other end of the cycle, if cycles there are going to be, the worse is the trading period and the conditions in which trade is carried on, the greater must be the taxation allowances.

Problem of Full Employment Is International

THE problem of eliminated or at least of minimizing trade cycles and thereby providing a solution to the major section of unemployment is one which is capable of official attack in many ways. But, whilst one Government may have a domestic policy which will achieve immediate beneficial results, a programme of isolation is hardly likely to bring about achievements of permanent duration. The problem of full employment whilst primarily a national one, is equally international and, without international understanding, co-operation and adjustment, no lasting progress can be anticipated.

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CAPITAL control is essential as a country attempting by strong means to reduce its unemployment figures to negligible proportions would find its achievements and hopes sadly upset if a sudden and unexpected flight of capital from the country in question was to take place. Successful economic isolation has been possible in the past, but it is very doubtful whether, after the present war, more than one or two countries will be able to entertain any practicable ideas about national self-sufficiency. To combat world unemployment and the menace carried with it, action must be internationally co-operative.

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ONE very important item must be given consideration in any plan to step up the degree of employment. A high degree of employment is sure to bring about labour bottle-necks. It will be well known from economic history that labour bottlenecks have given added power to organized labour. Bargaining of a certain nature is sure to ensue and labour is bound to win its case with a resultant rise in production costs, increased selling costs, the birth of a spiral and limited (perhaps uncontrollable) inflation.

✦ ✦ ✦

IN a totalitarian State, the problem of finding funds for the financing of industry would not arise. There is no occasion for the public to be stimulated in their provision of funds for investment, for industry will be nationally owned. Not so in the democratic States. If democratic life means the continuance of private enterprise uninfluenced by any great degree of State interference, it also infers the ability of the State to invest funds on a limited scale. To what extent should Governments encroach on what has hitherto been the preserve of private enterprise? Should Governments nationalise industries and should Governments set up Government-owned and Government-Controlled Boards and Commissions for trading etc? Is private investment and private enterprise likely to be interfered with by superimposed Government control? These points all have an immediate bearing on the problem of post war employment and unemployment.

✦ ✦ ✦

IT is not possible in an article of this description to tackle the really voluminous issues which arise from this problem. One thing only is certain amid the welter of ideas, thought and opinion which abounds and that is that a policy of full employment has been officially declared by one Power and that the other Powers in the world cannot, even had they the desire, fail to appreciate the correctness of such an objective.

THE LOS ANGELES REGIONAL MEETING OF THE WIRE ASSOCIATION

Will be held on JUNE 8, 1944, at the Biltmore Hotel

Arrangements have been concluded for the holding of the annual Los Angeles Regional Meeting on June 8th. Attendance will be limited to 50 persons under the current O.D.T. restrictions on meetings.
An informative and timely technical session is being arranged, the details of which will be announced later. Meanwhile, we hope that those of our members who can attend, will make plans accordingly and send reservations to:

RICHARD E. BROWN, Executive Secretary

THE WIRE ASSOCIATION

300 MAIN STREET STAMFORD, CONN.

Registration Fee — $4.00 — Including Dinner

Relative Workability of Metals

By A. G. H. Anderson,
Metallurgical Engineer, Oakdale, N. Y.

Some additional notes on the problem of stresses involved in the deformation of metal by wire drawing. Original data published in March, 1943, Wire & Wire Products. ✦ ✦ ✦ ✦ ✦

ON looking over the figures given in the original article under the same title published in March, 1943, and considering their meanings in terms of atomic quantities, I am sure that much information of both practical and scientific utility can be revealed by further experiments similar to those already published.

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IN order eventually at some future time to get some technical organization interested in such investigations and perhaps obtain some comments from the engineering profession, I should like to present a few notes on the subject.

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IN the original article it was shown that $E/d = P/d = A + B\sqrt{S}$ approximately, and that E varies slightly with d. Thus we may write with closer approximation $E=(A+B\sqrt{S})\ d^m$ where P = pull in Lbs. per inch square, d = draft in per cent, S = cold worked state of metal and D = diameter of die. For the sake of comparing the original data under standard conditions, D was chosen .257 inch and d as 21% more or less arbitrarily. Under these conditions, for the annealed state, $P/d = Z_0$, and generally $Z = (A + B \times \sqrt{S}) = Z_0 + \triangle Z$.

✦ ✦ ✦

CONVERTING the values of Z and B given in table III of the original article into gr.cm. per cm. cube and plotting log Z against the logarithms of the atomic radii in Angstroms we find that with the exception of the figure for lead the points lay fairly closely on a straight line so that the following expression for Z can be deduced: $Z = 2.5 \times 10^8 \times r^{-9} = \phi \times r^{-9}$.

SIMILARLY plotting $B \times r^3\ N$ where N is atomic number against the melting points we obtain the expression $B = 3N\triangle T\ r^{-3}$ (2). $\triangle T$ is the difference between melting point and testing temperature.

✦ ✦ ✦

THUS for the metals iron, copper, zinc, aluminum and tin, the approximate expression $Z=\phi r^{-9} + -N\ r^{-3}\ \triangle\ T\sqrt{S}$ (3) holds.

✦ ✦ ✦

HERE r^{-9} is equivalent* to the atomic density cubed, and Nr^{-3} is equivalent* to the electron density; that this quantity should have a major influence upon the hardness imparted to metals by repeated slip is rather enlightening to the slip theory of metallic strength as well as to the x-ray diffraction patterns of cold worked metals.

✦ ✦ ✦

IT would be very interesting to obtain comparable experimental figures for all ductile metals. It may then be questioned whether the factor ϕ is itself a function of atomic properties so that we may have ϕ_1, ϕ_2 — ϕ_n for various groups of metals. That this may indeed be expected may be inferred for instance from Goldsmith's work on ionic compounds, whose hardness varies both with atomic diameter and with ionic charge. Similar variables may operate in metallic lattices to affect their cohesive strength.

IT is well known that the hardness numbers of metals obtained by the various penetration methods do not give the initial hardness of metals, but are affected by the cold work imparted during the process of testing itself. **Mayer** did devise an empirical expression to account for this fact.

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THE hardness of metals, as is well known, is dependent upon their melting points, those of high melting points generally being the harder. In equation (2) the dependency of the hardenability factor B upon the melting points is quantitatively very striking.

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ϕ and perhaps also Θ in equation (3) should vary with temperature, and tests conducted throughout a wide range of temperatures to determine their variations may yield interesting results. Tests run on ductile metals as well as on the solid solutions of selected representative alloy systems may be expected to reveal information useful to crystal chemistry as well as the hardness theories. Such experiments may also contribute practical engineering data on high and low temperature properties of the metals, tensile strength, impact strength and fatigue limits. The tensile strength, although obviously related to $z = (A + B\sqrt{S})$ is, however, not proportional to this quantity.

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THESE notes embody some of the thoughts I have given to the problem of cohesion, hardness and workability. Discussion is invited.

*With a certain amount of approximation.

A New Development in Insulation

By H. D. Minich
Tensolite Corporation
New York, N. Y.

Mr. Minich is president of the Tensolite Corporation, New York, N. Y. Although their war activities are already widely known, we asked for this brief review of their work so that electronics engineers and executives might become better acquainted with this unique process.

THE "tensulation" process is of unusual interest to users of the smaller and more flexible electrical conductors.

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WITH this new and versatile process it becomes entirely practical to provide cordage, hook-up wires, small flexible cables, etc., that are "tailor-made" to suit the special needs of those who use them. By variations of the process, and by combinations of new synthetic insulation materials, it is possible to secure results that heretofore were unobtainable.

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THE distinctive feature of this new process is its use of thermoplastic, thermoelastic and other film material in tape form—applied **parallel** to the conductor **after** the film has been heated to the precise temperature required for its complete lamination and coalescence. It then is instantly drawn and wrapped in numerous layers until the desired wall thickness is obtained. Finally, more heat and pressure are applied from all directions to assure a perfect product. Of course, in addition to the "tensulation" process, the conductors (cabled or singly) may be covered with metal or fabric braid, lacquers and other coatings for the special end-uses for which they are intended.

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ALTHOUGH no dies are used, the insulating wall is uniform, free from pinholes, light in weight and small in size.

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THE synthetic materials that have lately become available assure freedom from sulphur, HCl and other injurious materials, and give exceptionally high resistance to oil, acid, alkali, brine, water, corona, abrasion, flexing, etc., meeting many conditions where rubber would be unusable. They have high dielectric characteristics, long life, and are not affected by exposure to sun and air. They include the vinyl polymers and copolymer resins, vinyl-chloride-cellulose and numerous others.

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VARIOUS colors are available in the materials themselves, and additional coding may be obtained by other means, such as the use of colored thread tracers.

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PRODUCTION of "tensulated" conductors is presently confined principally to the lighter and more flexible stranded constructions composed of tinsel or of the finer gauge wires in the following general classifications:

(1) **Instrument Cordage**
Tensulated instrument cordage is supplied regularly to various well-known instrument manufacturers. This cordage is able to stand the greatest amount of flexing and handling even at low temperature. These users are manufacturers of telephone head-sets, hearing aids, inter-communication equipment, audiometers and similar instruments.

(2) **Hook-Up Wire**
Tensulated hook-up wire is supplied according to standard specifications and, also, according to special requirements of various manufacturers and laboratories. Such wire is used in radio, radar, and in other applications, some of which still are of a secret nature and may not yet be described.

(3) **Resistance Wire**
Tensulated resistance wire has been supplied in large quantities for use as the heating elements of electrically heated suits, gloves, shoes, goggles and heated casualty pads. These are used by the Armed Forces in high altitude flying and for other purposes. Small size, flexing at low temperature and resistance to heat and perspiration are, of course, the principal advantages. Post-war applications of these materials are far along in development for use in heated blankets, heated mattresses and other products.

(4) **Flexible Cables**
On request, various types of special cables (including the coaxial type and shielded cables) have been developed for many special uses where small size, special insulation and great flexibility are important.

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THE latest problem presented has been the production of hookup wire and instrument cordage material, suitable for use in the tropics, that would withstand the action of mold and mildew and, at the same time, meet all other requirements.

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IT is now well known that in the tropics, radio, telephone, radar and similar equipment becomes inoperative in very short time unless the individual parts — and especially the wires — are properly protected. Tensolite primary insulation is, in most cases, adequate in itself, but working in collaboration with the manufacturers of fungicide-containing lacquer, products have been developed that have double and triple protection. The materials used have been specifically approved by the Signal Corps for such purpose. Such products now are being furnished on sufficiently high priority and precedence. Similar problems met in domestic use such as in mines, etc., are being solved by similar materials.

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THE covering of wire by the Tensolite process was a natural war-

time evolution from coating cords with plastics and from making solid plastic cords, ribbons, yarn, bristles and related products. This process, which is neither dipping, extruding nor the conventional wrapping, is licensed to The Tensolite Corporation of which the inventor is owner and manager.

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IMMEDIATELY after Pearl Harbor, The Tensolite Corporation went all-out for the development of products urgently needed by the Armed Services. Some of their uses cannot yet be revealed, but most of them involve special types of wire insulation utilizing the latest products of the plastic industry, together with this newest technique of application.

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FORTUNATELY, the company already was prepared to meet many of the new needs created by high altitude flying and by the operation of electronic equipment under polar, tropical and submarine conditions. By active and extensive research, improvements that normally might have required a decade were developed in a few years and, even, months.

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AT present, these new techniques are limited almost entirely to the war effort but, with new equipment some additional production is now being scheduled and research is going forward rapidly in connection with the requirements of the post-war world.

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OBVIOUSLY, this process cannot solve all wire and cordage problems. For example, it still is not applicable to the jacketing of heavy cables or the covering of the heavier solid wires. However, it is a versatile process that meets many specific new requirements, and supplies superior conductors for many of the usual applications.

Capacity, Production And Shipments Of Rolled Iron And Steel Products

(For December, 1944)

As reported by American Iron and Steel Institute

Steel Products	Number of companies	Items	Maximum Annual Potential Capacity Net Tons	Current Month: Production: Net Tons	Current Month: Production: Per cent of capacity	Current Month: Shipments (Net Tons): Total	Current Month: Shipments (Net Tons): To members of the industry for conversion into further finished products	To Date This Year: Production: Net Tons	To Date This Year: Production: Per cent of capacity	To Date This Year: Shipments (Net Tons) *: Total	To Date This Year: Shipments (Net Tons) *: To members of the industry for conversion into further finished products
Ingots, blooms, billets, tube rounds, sheet and tin bars, etc.	51	1	xxxx	xxxx	xxx	680,817	199,143	xxxx	xxx	8,701,186	2,747,778
Structural shapes (heavy)	14	2	9,429,250	321,526	42.7	302,462	xxxx	3,834,708	42.1	3,835,601	xxxx
Steel piling	4	3		18,472		21,204	xxxx	137,662		132,513	xxxx
Plates (sheared and universal)	27	4	17,583,220	868,919	58.5	864,807	45,415	13,192,660	75.0	12,866,213	625,061
Skelp	6	5	xxxx	xxxx	xxx	68,996	60,062	xxxx	xxx	839,189	668,274
Rails—Standard (over 60 lbs.)	4	6	3,625,000	188,664	61.6	199,200	xxxx	2,305,303	63.6	2,290,779	xxxx
—All other	6	7	526,000	12,529	28.2	13,657	xxxx	185,878	35.3	192,671	xxxx
Splice bars and tie plates	13	8	1,747,260	52,049	35.2	54,108	xxxx	769,949	44.1	789,285	xxxx
Track spikes	10	9	350,640	12,386	41.8	13,163	xxxx	147,376	42.0	156,260	xxxx
Hot Rolled Bars—Carbon	39	10	xxxx	675,024	xxx	554,362	80,068	8,658,581	xxx	7,121,278	933,526
—Reinforcing—New billet	15	11	xxxx	54,928	xxx	63,391	xxxx	543,628	xxx	573,998	xxxx
—Rerolled	14	12	xxxx	3,898	xxx	4,064	xxxx	67,342	xxx	79,524	xxxx
—Alloy	25	13	xxxx	241,759	xxx	175,867	18,055	3,054,638	xxx	2,241,525	237,667
—Total	47	14	22,264,720	975,609	51.8	797,684	98,123	12,334,189	55.4	10,016,325	1,171,193
Cold Finished Bars—Carbon	24	15	xxxx	141,557	xxx	139,527	xxxx	1,786,599	xxx	1,775,046	xxxx
—Alloy	23	16	xxxx	29,308	xxx	24,885	xxxx	413,854	xxx	372,927	xxxx
—Total	30	17	2,940,910	170,865	68.7	164,412	xxxx	2,200,453	74.8	2,147,973	xxxx
Tool steel bars	17	18	271,460	12,658	55.2	12,577	xxxx	147,369	54.3	141,684	xxxx
Pipe and Tubes—Butt weld	16	19	2,162,520	116,910	63.9	122,235	xxxx	1,435,674	66.4	1,437,910	xxxx
—Lap weld	8	20	842,200	45,599	64.0	46,306	xxxx	577,602	68.6	574,242	xxxx
—Electric weld	10	21	1,344,900	73,273	64.4	75,742	xxxx	859,929	63.9	857,119	xxxx
—Seamless	15	22	2,678,100	180,117	79.6	191,963	xxxx	2,336,555	87.2	2,356,483	xxxx
—Conduit	7	23	187,000	7,051	44.6	6,524	xxxx	63,596	34.0	63,489	xxxx
—Mechanical tubing	12	24	1,117,600	65,375	69.2	59,994	xxxx	826,542	74.0	805,421	xxxx
Wire rods	27	25	7,058,470	362,464	60.7	98,304	32,927	4,610,251	65.3	1,365,127	435,453
Wire—Drawn	42	26	5,653,440	285,720	59.8	179,781	9,575	3,652,728	64.6	2,178,345	104,294
—Nails and staples	19	27	1,249,020	46,413	44.0	48,262	xxxx	642,497	51.4	635,388	xxxx
—Barbed and twisted	15	28	546,390	20,276	43.9	20,924	xxxx	253,788	46.4	251,990	xxxx
—Woven wire fence	16	29	1,106,200	31,937	34.2	32,354	xxxx	384,879	34.8	382,205	xxxx
—Bale ties	12	30	152,500	5,167	40.1	5,198	xxxx	75,235	49.3	76,156	xxxx
Black Plate—Ordinary	9	31	xxxx	xxxx	xxx	34,820	239	xxxx	xxx	489,222	1,504
—Chemically treated	8	32	464,000	6,999	17.8	7,226	xxxx	126,950	27.4	120,695	xxxx
Tin and Terne Plate—Hot dipped	9	33	3,718,850	165,545	52.7	172,844	xxxx	1,992,276	53.6	2,000,317	xxxx
—Electrolytic	10	34	2,173,850	58,567	31.9	61,043	xxxx	649,556	29.9	604,968	xxxx
Sheets—Hot rolled	29	35	19,536,820	1,109,461	67.2	508,791	30,255	12,865,583	65.9	6,413,344	300,965
—Cold rolled	12	36	7,072,260	371,507	62.1	194,157	xxxx	3,826,140	54.1	2,031,477	xxxx
—Galvanized	16	37	2,892,130	132,394	54.1	129,108	xxxx	1,389,866	48.1	1,378,077	xxxx
Strip—Hot rolled	23	38	7,117,390	210,405	35.0	130,511	17,058	2,671,962	37.5	1,703,148	264,621
—Cold rolled	36	39	3,146,110	113,312	42.6	103,253	xxxx	1,270,281	40.4	1,191,365	xxxx
Wheels (car, rolled steel)	5	40	319,400	25,687	95.1	25,839	xxxx	300,429	94.1	296,495	xxxx
Axles	6	41	408,170	8,711	25.2	10,162	xxxx	186,921	45.8	184,726	xxxx
All other	5	42	168,790	4,146	29.1	3,705	xxxx	48,018	28.4	46,523	xxxx
TOTAL STEEL PRODUCTS	155	43	xxxx	xxxx	xxx	5,458,133	492,797	xxxx	xxx	69,553,911	6,319,143
Effective steel finishing capacity	155	44	64,722,000	xxxx	xxx	xxxx	xxxx	xxxx	xxx	xxxx	xxxx
Percent of shipments to effective finishing capacity	155	45	xxxx	xxxx	xxx	90.7 %	xxxx	xxxx	xxx	97.7%	xxxx

During 1943 the companies included above represented 98.9% of the total output of finished rolled steel products as reported to American Iron and Steel Institute.

* Adjusted.

lated so as to give when melted a slag with properties best suited for the efficient refining of the metal. Chemical analysis and visual examinations are made of standard pancake slag samples. The slag samples are classified according to color, surface design, lustre, density and structure, thus rapidly supplying to a surprising degree of accuracy, information as to chemical relationship such as lime-silico ratio or basicity and iron oxide content.

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AN important aid to proper slag control in the open hearth furnace is the control of temperatures. A great deal of scientific research has been conducted on this subject in recent years and a control developed which has been very helpful in the general improvement of steel quality. Accurate information on the temperature of the bath during the refining period is essential in obtaining and maintaining conditions such as will assure the highest degree of purification as well as the required conditions for proper teeming in the molds. Both radiation and optical pyrometers are being employed in this connection and in recent years various types of high temperature measuring thermo-couples have furnished valuable data particularly on temperatures of furnace roof and walls.

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Developments in Ingot Practices

THE chemical analysis and state of oxidation of the liquid steel tapped from the melting furnace is determined by the desired ingot mold practices and the ultimate application. Ingot practice is determined by the extent to which deoxidation has been effected before the steel is teemed into the molds. In order of decreasing oxygen content, the typical mold practices may be described as rimmed, capped, semi-killed and killed. Deoxidation is regulated in both the furnace and ladle according to predetermined schedules for the various grades produced.

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IN the production of a rimmed ingot, such as depicted in Figure 6-A, the desired action requires a relatively high oxygen content so that a rapid gas evolution or effervescence will occur in the mold. Sluggish ac-

CORRECTION: As the cuts on page 30, January 1945, in Mr. Reeder's lecture were not legible, the page is here reproduced using new photographs to facilitate an understanding of the paper.

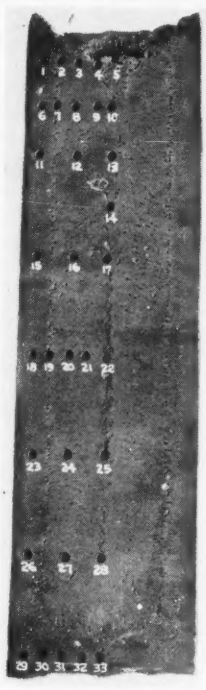

Fig. 6A

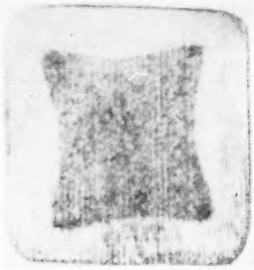

Fig. 6C

Fig. 6B

CHEMICAL ANALYSES

	C	Mn	P	S
1	.068	.45	.012	.015
2	.203	.60	.030	.049
3	.193	.56	.030	.046
4	.219	.63	.043	.068
5	.290	.77	.060	.108
6	.070	.47	.013	.016
7	.144	.55	.019	.041
8	.155	.51	.028	.036
9	.165	.50	.032	.044
10	.150	.56	.031	.049
11	.071	.45	.014	.014
12	.152	.53	.030	.036
13	.146	.52	.032	.031
14	.165	.52	.029	.046
15	.077	.45	.012	.012
16	.156	.52	.024	.043
17	.168	.53	.027	.042
18	.068	.47	.013	.014
19	.157	.49	.017	.031
20	.143	.49	.021	.038
21	.136	.52	.022	.038
22	.175	.51	.023	.037
23	.073	.45	.012	.015
24	.127	.50	.018	.032
25	.123	.49	.017	.032
26	.081	.48	.013	.018
27	.113	.47	.018	.028
28	.108	.48	.017	.026
29	.108	.45	.014	.021
30	.105	.48	.014	.020
31	.100	.49	.014	.017
32	.088	.48	.016	.017
33	.090	.47	.017	.016

Fig. 6A. Longitudinally Split Rimmed Ingot. Note locations of drillings for Chemical Checks.
Fig. 6B. Chemical Analysis of drillings taken at the numbered locations (see fig. 6A)
Fig. 6C. Deep etched cross section of 1¾" billet, rolled from a Rimmed Ingot of heat from which split ingot (Fig. 6A) was taken.

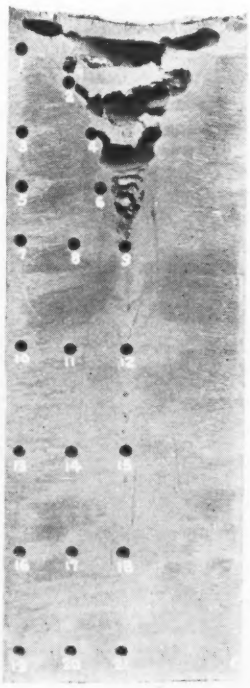

Fig. 7A

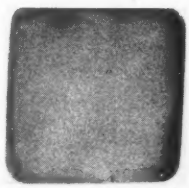

Fig. 7C

Fig. 7B

CHEMICAL ANALYSIS

Ladle	C.	Mn.	P.	S.
.18	.48	.013	.018	
1	.18	.43	.017	.019
2	.16	.46	.015	.017
3	.18	.43	.015	.020
4	.18	.45	.017	.020
5	.17	.44	.017	.020
6	.21	.47	.018	.024
7	.17	.44	.017	.020
8	.18	.45	.018	.020
9	.19	.45	.018	.029
10	.17	.45	.015	.021
11	.18	.43	.016	.020
12	.17	.44	.015	.020
13	.18	.44	.015	.019
14	.19	.44	.015	.022
15	.16	.42	.017	.020
16	.18	.43	.015	.020
17	.16	.42	.017	.019
18	.16	.42	.016	.019
19	.18	.44	.015	.020
20	.16	.42	.016	.020
21	.17	.43	.016	.020

Fig. 7A. Longitudinally split Killed Ingot. Note locations of drillings for Chemical Checks.
Fig. 7B. Chemical Analysis of drillings taken at the numbered locations. (see fig. 7A)
Fig. 7C. Deep etched cross section of 1¾" billet, rolled from a Killed Ingot of heat from which split ingot (Fig. 7A) was taken.

GOVERNMENT WIRE PRODUCTION INFORMATION

Communication Wire Output in December Up 6%

THE following survey of problems and progress in the production of critical communication wire prepared under the direction of Hiland G. Batcheller, Chief of Operations, was made public by the W.P.B.

✦ ✦ ✦

ALTHOUGH December production of 188,500 miles of the three types of critical communication wire —assault, long range communication and field—was up 6% over November, it fell 2% short of the forecast for the month. All of the deficit was in assault wire and long range communication wire. Field wire output ran ahead of schedule. The production trend throughout 1944 was upward, but requirements have risen much faster.

AN AA-1 priority rating has been granted to provide the necessary equipment for increasing production capacity of field wire and assault wire. This will represent increases over the December rate of production of 45% and 71%, respectively.

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BECAUSE of the tight supply of high-carbon steel wire, manufacturers are now permitted to make one of the four steel strands of field wire conductors out of low-carbon galvanized steel wire. As a result, one large manufacturer — the **General Cable Company** — has hopes of increasing its schedule by 12,500 miles in March and 37,500 miles a month thereafter.

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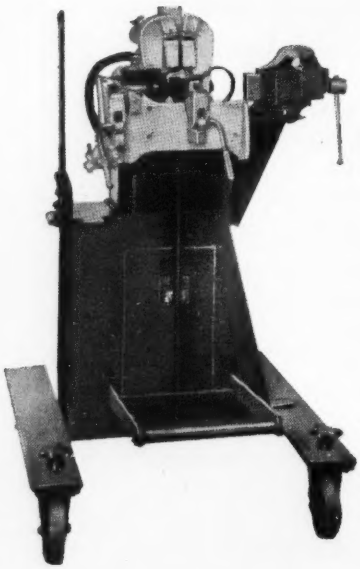
HOWEVER, there is a question as to whether a sufficient quantity of low-carbon galvanized .013-inch wire can be produced, since the same facilities are used to turn out .0095-inch steel wire for assault wire. Furthermore, these facilities compete with wire for wire rope, both of which are in short supply. The Steel Division has established load directives on the mills for sufficient .013-inch steel wire to meet the field wire manufacturers' quotas. Any failure on the part of steel mills to meet these directives would immediately be reflected in lower deliveries from the copper wire mills, because the latter have no operation inventories and the present schedule does not allow for accumulation of steel wire. Stranding machines are being added, but projects in process are as yet insufficient to meet the increased schedules.

MICROMETER PRECISION MICRO-WELD TRADE MARK REG. U. S. PAT. OFF.

CONTINUOUS IMPROVEMENT

MICRO-WELDERS with dial indicating annealing attachments are now available for high carbon wire.

There is positive control of annealing temperature and already hundreds of these special MICRO-WELDERS are proving their dependability and satisfactory performance with leading manufacturers.



MICRO PRODUCTS COMPANY

20 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Telephone, State 7468

Wire and Cable Makers Urge Action to Relieve Shortages of Wire Covering Materials

MEMBERS of the Copper Wire and Cable Mill Industry Advisory Committee reported to W.P.B. that they are not getting enough plasticizer of the type required for heavy duty field wire and requested that action be taken to relieve this situation. The industry representatives said that resin was in sufficient supply for other wire requirements but that the heavy wire situation demanded attention.

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THEY also showed concern over the supply of carbon black, another necessary component, and recommended that W. P. B. relax the order which will cut back consumption of carbon black 10,000,000 pounds per month to help meet the increased truck tire program. Industry members pointed out that the requirements of copper wire producers for carbon black are not large but are necessary for critical war programs.

Truck Tire Chain Order Amended

MILITARY truck tire chains and parts have been added as undesignated products in an amendment to Table 12 of WPB General Scheduling Order M-293, according to the Tools Division of the War Production Board.

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AT the same time Direction 1 to Table 12 was revoked. Large users of anti-friction bearings will no longer be required to file Form WPB-3333, stating their bearing requirements, Tools Division officials said.

✦ ✦ ✦

Wire in War

IN a recent bulletin issued by the War Department on gun locators, the fact is mentioned that approximately ten miles of wire are required to connect the microphones to the recording station. The microphone array in sound ranging is often spread out over a distance of from 10,000 to 15,000 yards. Sound ranging methods require a number of special microphones set up at intervals behind the front lines, each of which is connected with the central sound ranging system by wire lines.

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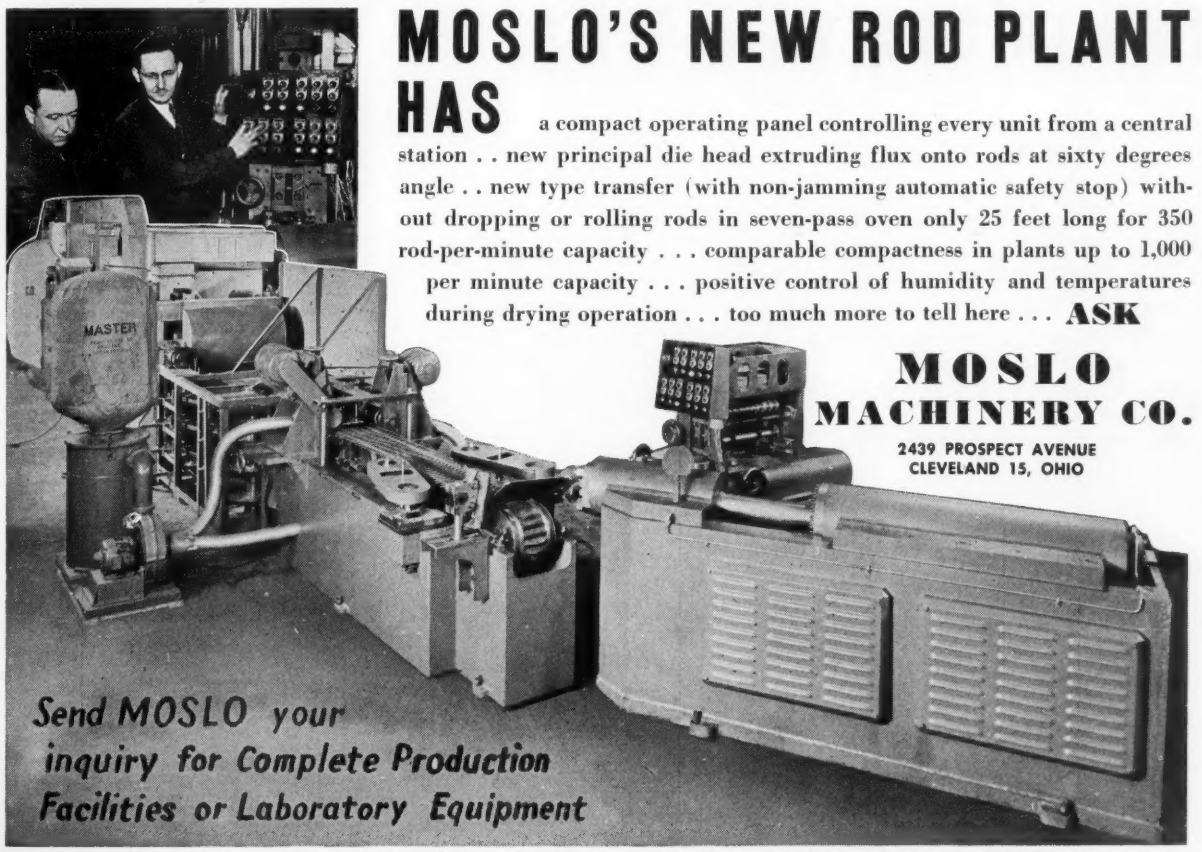
Demand for Wire Continues Heavy

GALVANIZING operations on wire are being formed out on sub-contracts to expedite the delivery of this type of wire for urgent war needs, including tire bead wire. Some hose wire for refueling lines is being copper finished instead of galvanized. Demand for this item is high. Some mills are booked through the year on galvanized wire. No decline in the heavy orders for war consumption is in sight. Directives contrive to apply to a large portion of the production. Concentration of large tonnages in the same size ranges is a bottle neck in drawing. Orders for springs keep the backlog heavy, with deliveries on music wire running into the third quarter on some sizes.

(Please turn to page 208)



MOSLO'S NEW ROD PLANT HAS a compact operating panel controlling every unit from a central station . . new principal die head extruding flux onto rods at sixty degrees angle . . new type transfer (with non-jamming automatic safety stop) without dropping or rolling rods in seven-pass oven only 25 feet long for 350 rod-per-minute capacity . . . comparable compactness in plants up to 1,000 per minute capacity . . . positive control of humidity and temperatures during drying operation . . . too much more to tell here . . . **ASK**

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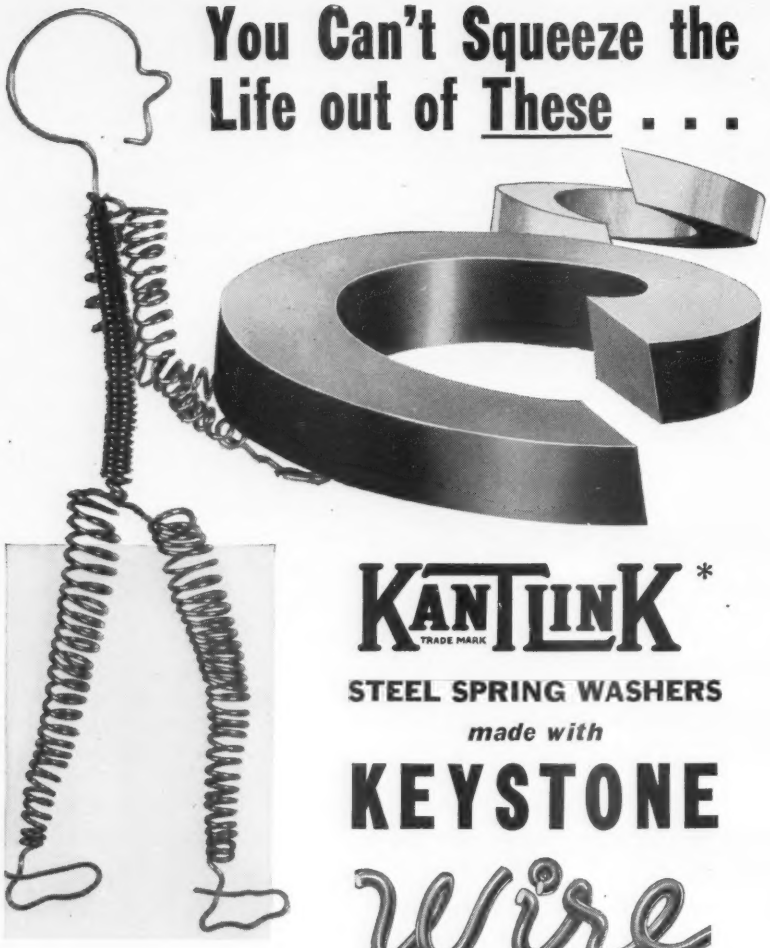
Send MOSLO your inquiry for Complete Production Facilities or Laboratory Equipment

You Can't Squeeze the Life out of These . . .



KANTLINK* TRADE MARK

STEEL SPRING WASHERS

made with

KEYSTONE Wire

TIGHT—the Kantlink Steel Spring Washer exerts constant pressure . . . keeps nut from loosening.

STILL TIGHT Though the nut never turned, the other parts wore and stretched. Kantlink's expanding spring action continues to hold nut securely in place.

Steel in spring washers is subjected to extreme pressure. Here sustained resiliency, toughness and "bite" under terrific force are "musts". Special Keystone heat-treated high carbon steel wire supplies these qualities in good measure . . . as proved by the satisfactory performance of Kantlink steel spring washers in a wide variety of applications. Kantlink steel spring washers are more widely used than any other kind . . . evidence of their sterling ability to "stand the gaff".

Regardless of the performance demanded in wire products, Keystone has been able to supply the materials that meet the most exacting engineering requirements.

KEYSTONE STEEL & WIRE CO.
Peoria 7, Illinois

**The National Lock Washer Company, Milwaukee, Wisconsin*

Special Analysis Wire for All Industrial Uses

SAMSON SPRING WIRE — REG. U.S. PAT. OFF. — KEYSTONE STEEL & WIRE CO. PEORIA, ILL.

Coppered, Tinned, Annealed, Galvanized

Government Wire Production Information

(Continued from page 207)

Wire Makers Needed to Speed Army Orders

AN appeal for workers to fill shortages in plants manufacturing field and assault wire used by Army communications systems was issued recently by Brig. Gen. Stewart E. Reimel, chief of the New York Ordnance District.

✦ ✦ ✦

GENERAL Reimel estimated that Army needs for field wire approximate 179,000 miles a month, contrasted with production which at its peak in November supplied only 130,000 miles.

✦ ✦ ✦

ASSAULT wire, used for advance communications and considered completely expendable, has been required at a rate of 57,000 miles a month, compared with only 36,564 miles turned out in November, and the 1945 goal has been upped to 64,000 miles.

✦ ✦ ✦

GENERAL Reimel listed the following plants among those who can use additional help:

General Cable Corporation, in Long Island City, N. Y., and in Bayonne and Perth Amboy, N. J.; Acorn Insulated Wire Company, Brooklyn, N. Y.; Circle Wire and Cable Company, Maspeth, N. Y.; Phelps Dodge Copper Products Company at Bayway and Elizabeth, N. J.; Federal Telephone and Radio Company, Nutley, N. J.; Okonite Calendar Company, Paterson, N. J., and Triangle Conduit and Cable Company, New Brunswick, N. J.

✦ ✦ ✦

Demand for Screw Machine Products Up 80%

REQUIREMENTS for screw machine products are approximately 80% greater at present than in January, 1944, as a result of increases in major ammunition programs, War Production Board officials informed the Screw Machine Products Industry Advisory Committee at its recent meeting. Artillery fuses and boosters, and mortar fuses are the most urgently needed items for which screw machine products must be provided.

CHIEF factor now limiting production of screw machine products is lack of skilled manpower. Discussion brought out that from three to four years' training is required for skilled workers and that unless they are available for key positions, workers with lesser skills cannot be utilized. The industry is producing at only 60% of capacity, due to loss of skilled workers. To bring production up to full capacity of existing facilities, a minimum of 5,000 set-up men are needed and if these can be obtained an additional 50,000 workers can be used.

✦ ✦ ✦

ADDITIONAL facilities must also be brought into production. A canvas of the industry is difficult since it consists of some 3,000 firms, producing on both a jobbing and integrated plant basis. Industry members were asked by W.P.B. officials to assist in locating idle facilities.

✦ ✦ ✦

W.P.B. Suspends C.M.P. Reg. No. 9 and Sharply Tightens Provision of C.M.P. No. 9-A

BECAUSE of the critical need of the armed forces for a sharply-increased supply of field wire, the War Production Board announced the suspension of Controlled Materials Plan Regulation No. 9 and Amendment of C.M.P.-9a. C.M.P.-9 is the regulation that permitted retail stores to purchase copper wire for sale to civilians, and C.M.P.-9a provides copper wire for use by civilian repair shops. Industrial procurement under C.M.P.-9a is not affected.

✦ ✦ ✦

C.M.P.-9 is not revoked, but will be kept on the books in a state of suspension through June 30th.

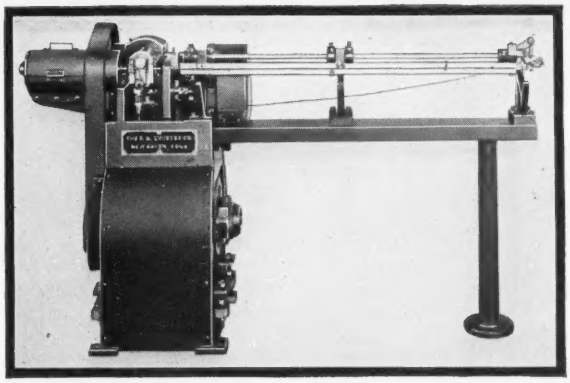
✦ ✦ ✦

SUSPENSION of the regulation does not affect the sales of copper wire under Direction 21 to C.M.P.-1, which provides for the farmers' copper wire allotment certificate.

✦ ✦ ✦

THE limits on the repairman's purchase of copper wire under C.M.P.-9a are reduced as of today to $75 worth of wire per calendar quarter or 10% of what the repairman used in 1941, whichever is higher.

(Please turn to page 210)



SHUSTER WIRE STRAIGHTENER TYPE A
Wire Capacity 1/32" - 1/16" Diameter

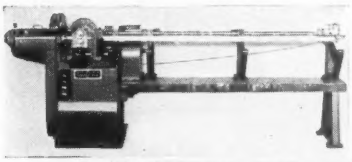
Faster Cutting Speeds
GREATER PRODUCTION!

✦

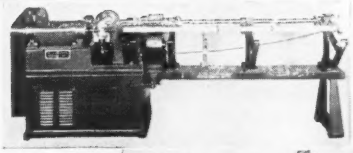
Outstanding Features—

Almost continuous wire travel
Lightning cut-off assures square-cut ends
High speed, direct driven 5-die straightening flier
Quiet, highly efficient V-belt motor drive
Ball and roller bearings throughout
Extremely rigid construction
Fully guaranteed as to material and workmanship

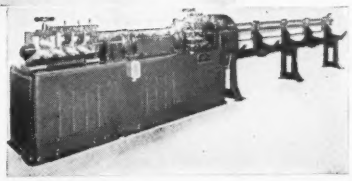
New descriptive folder on request



Type 1A
1/16" - 3/16"
Dia.



Type 2A
1/8" - 1/4"
Dia.



Type 3A
3/16" - 3/8" Dia.

Type 4A (not shown)
3/8" - 5/8" Dia.

The F. B. Shuster Mfg. Co., Inc., New Haven, Conn.

SHUSTER
Automatic
WIRE STRAIGHTENING
AND CUTTING
MACHINES
Since 1866

Government Wire Production Information

(Continued from page 209)

Aluminum

TOTAL production for the first quarter of 1945 is estimated to be 275,000,000 pounds, approximately 100,000,000 pounds less than indicated requirements.

✦ ✦ ✦

THE Government primary stocks as of December 31, 1944, were estimated to be 534,000,000 pounds or four and one-half months' consumption; secondary stocks amounted to 31,000,000 pounds. Stocks at reduction plants were reported to be almost negligible.

✦ ✦ ✦

SHIPMENTS of rod and bar have been falling off gradually. A 40 per cent increase in the demand for rod and bar may materialize in the early part of 1945 if forge stock inventories are as low as is suspected. Because of the fact that employment in the rod mills has decreased substantially in the last year, it will no doubt be necessary to employ an additional 500 to 750 workers as soon as the order loads on the mills actually materialize.

✦ ✦ ✦

SHIPMENTS of rivet wire have been approximately 1,000,000 pounds a month less than rivet production during the last quarter, which indicates that rivet producers are probably operating on minimum stocks of wire. This also means that there will soon be a pent-up demand for more rivet wire to meet the increasing aircraft programs. As in the case of rolled structural shapes, any additional production of wire will automatically cut into the production of rod and bar.

✦ ✦ ✦

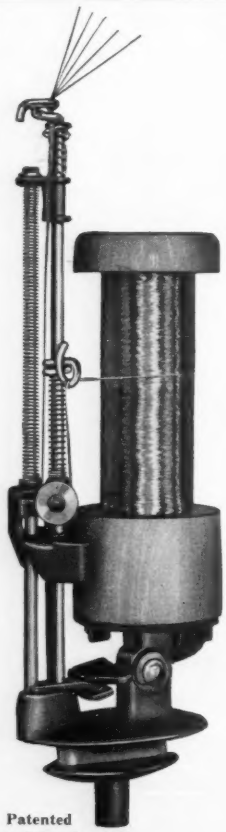
The Manufacture of Aircraft Instrument Springs

(Continued from page 191)

addition to the Beryllium, producing a marked change in the micro-structure in this metal, will enable the manufacturer of springs; which after the proper stress relief treatment, exhibit creep of not more than .3% in 100 hrs.

✦ ✦ ✦

IF the spring maker has attempted, and in some cases, achieved, the impossible, on the interest of furthering the War effort, he has incidentally, helped himself and the cause of springs generally. Some of the most accurate instruments used by the Air Corps and the Signal Corps, are dependent upon the precise and unfailing operation of a spring. Where 20 years ago springs were looked upon with something akin to suspicion, the precision achieved with these members during the last few years, will without question, result in their more frequent inclusion in the design of accurate peace-time instruments, an dthe precision spring, which reached its present stage of perfection during the War, is sure to play an important role in industry afterwards.



Patented
2 BX - Special
MOSSPEED Carrier.

MOSSPEED BRAIDER CARRIERS
FOR BRAIDING
MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE, ETC.

Will braid multiple ends of fine aluminum, brass, bronze or copper wire, etc.

SHEAVE-WHEEL on braider-stop and SPECIAL-THEADEYES on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems

MOSSBERG
Pressed Steel Corp.

18 West Street
Attleboro, Massachusetts, U. S. A.

European Agent
James Day (Machinery), Ltd., "Ford House," 88 Regent St., London, W. I., England
Ross Whitehead & Co., Ltd., Montreal and Toronto, Canada.

A Review of Recent Wire Patents

No. 2,366,208, METHOD OF COLD-DRAWING METAL, patented January 2, 1945, by Harley A. Montgomery, Highland Park, Mich.

✦ ✦ ✦

In drawing ferrous metals, the metal is immersed in a bath composed of an oleaginous material, sulphur and water until a heavy black iron sulphide coating has formed thereon, and then removing the metal from said bath and subjecting said coated metal to a drawing operation.

✦ ✦ ✦

No. 2,366,271, APPARATUS FOR STRIPPING MATERIAL, patented January 2, 1945, by Brooks W. Lerch, Baltimore, Md., assignor to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

✦ ✦ ✦

This machine is adapted to strip wire braids from shield-insulated cables.

✦ ✦ ✦

No. 2,366,359, METHOD FOR APPLYING INSULATING TUBING ON WIRE CABLES, CONDUITS, AND THE LIKE, patented January 2, 1945, by Marshall O. Searle, Beverly Hills, Calif.

✦ ✦ ✦

The tubing is disposed over the woven metal casing enclosing the conductor and the method comprises twisting one end of the loose metal strands at one end of the woven metal casing spirally upon itself to close this end of the conduit and partially inserting the closed end in one end of the cover, subjecting the cover to internal fluid pressure to expand the cover, and manually feding the expanded cover onto the casing.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents; outside United States and Canada, $1.00. Address, Wire & Wire Products, 300 Main St., Stamford, Conn.

✦ ✦ ✦

No. 2,366,509, ELECTRIC CONTACTOR FOR WIRE OR SHEETS, patented January 2, 1945, by Herbert H. Francisco, Bethlehem, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania.

✦ ✦ ✦

A moving strand of wire enters a conical-shaped housing, containing a mass of compressible, electrically-conducting material, which is retained in contact with the wire.

No. 2,366,528, EXTRUSION CENTERING WIRE GUIDE, patented January 2, 1945, by William C. Heath, Shorewood, Wis., assignor to A. O. Smith Corporation, Milwaukee, Wis., a corporation of New York.

✦ ✦ ✦

An extrusion nozzle wire guide is provided for axially aligning a moving strand with the center of an extrusion nozzle for coating the same.

✦ ✦ ✦

No. 2,366,846, BEDSPRING, patented January 9, 1945, by Charles J. Elder, Muncie, Ind., assignor to The Moore Company, Muncie, Ind., a corporation of Indiana.

✦ ✦ ✦

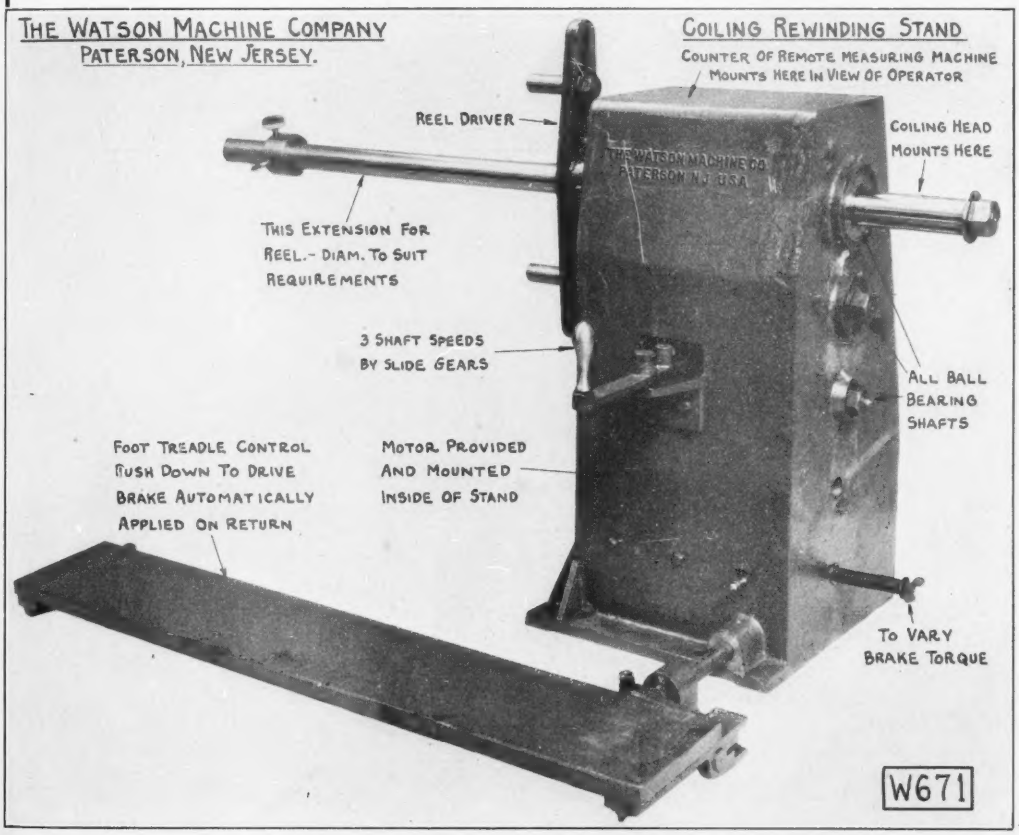
End turns of the coil springs, making up this bed-spring assembly, extend thru slots in the inner faces of the border frame, there being depending shoulders adjacent these slots to engage the spring ends and arranged to prevent their withdrawal from the slots.

✦ ✦ ✦

No. 2,366,962, NONSPLITTING NAIL, patented January 9, 1945, by Ernest J. Gair, Snyder, N. Y.

(please turn to page 212)

THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY, U.S.A.


THE WATSON MACHINE COMPANY
PATERSON, NEW JERSEY.
COILING REWINDING STAND
COUNTER OF REMOTE MEASURING MACHINE MOUNTS HERE IN VIEW OF OPERATOR
REEL DRIVER
COILING HEAD MOUNTS HERE
THIS EXTENSION FOR REEL.- DIAM. TO SUIT REQUIREMENTS
3 SHAFT SPEEDS BY SLIDE GEARS
ALL BALL BEARING SHAFTS
FOOT TREADLE CONTROL PUSH DOWN TO DRIVE BRAKE AUTOMATICALLY APPLIED ON RETURN
MOTOR PROVIDED AND MOUNTED INSIDE OF STAND
TO VARY BRAKE TORQUE
W671

THESE UNITS ARE WIDELY EMPLOYED IN WAREHOUSES AND SHIPPING ROOMS AND COMBINE REELING AND COILING IN A MINIMUMOFSPACE.

* * *

HEAT TREATED ALLOY SHAFT OF LENGTH TO SUIT AND DIAMETER TO 2 3/8", 28" FROM FLOOR.

* * *

1 H.P. MOTOR

* * *

SPEED RANGES:
31 - 54 - 108
or
45 - 98 - 137
R.P.M.

* * *

LITERATURE ON REQUEST.

A Recent Review of Wire Patents

(Continued from page 211)

The entering end of the nail has a V-shaped groove, providing cutting edges at the intersection of the groove walls and the periphery of the nail shank.

✦ ✦ ✦

No. 2,367,957, MACHINE FOR THE GRINDING OF SCREW THREADS, patented January 23, 1945, by Thomas Metcalfe, Birkly, Huddersfield, England.

✦ ✦ ✦

A master screw is so mounted that it may swivel and rotate, so that the end, which is in service, may be changed.

✦ ✦ ✦

No. 2,368,047, MACHINE FOR MAKING WELDED WIRE FABRIC, patented January 23, 1945, by William Sayles Southwick, East Lynn, Mass., assignor to Thomson-Gibb Electric Welding Company, Lynn, Mass., a corporation of Massachusetts.

✦ ✦ ✦

The assembly includes two sets of stay wire feeding and cutting devices associated with welding means, one set being so positioned on the main frame with relation to the other set that the wire fed in by the first set is fed in between adjacent welded wires of the second set, the two sets being operated to weld each of the lengths of fed-in stay wires to strand wires during the dwell of the intermittent feed of the strand wires whereby the stay wires of each set are welded to the strand wires at crossings which are spaced apart longitudinally a distance equal to the sum of the lengths of two successive meshes and in one cycle two stay wires are fed in and welded to strand wires and the fabric is advanced a distance equal to the sum of the lengths of successive meshes.

✦ ✦ ✦

No. 2,368,097, ELECTRIC CABLE SYSTEM, patented January 30, 1945, by Charles E. Bennett, Ridgewood, N. J., assignor to The Okonite-Callender Cable Company, Incorporated, Paterson, N. J., a corporation of New Jersey.

✦ ✦ ✦

An insulating wall of spirally wrapped paper strips is disposed about the wire conductor, this being rendered temporarily impervious to insulating fluid, under super-atmospheric pressure which is disposed about the wrapping. When the cable is loaded, the material which is employed to render the wrapping temporarily impervious, is disintegrated and the fluid may then penetrate between the layers of paper.

✦ ✦ ✦

No. 2,368,107, WIRE DRAWING EQUIPMENT, patented January 30, 1045, by Lawrence F. Black, Donora, and Albert L. Kefover, Webster, Pa., assignors to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

✦ ✦ ✦

In association with a vertical wire-drawing block, there are provided pins up which the wire coil grows from the block, a ring guided by the pins for engaging the top of the growing coil, a control switch for the block, and a lever system worked by the rising of the ring for operating the switch.

✦ ✦ ✦

No. 2,368,153, SLOW STARTING HIGH SPEED WIRE DRAWING BLOCK, patented January 30, 1945, by Frank G. Mog, Cleveland, George F. Wald, North Olmsted, and Samuel C. Whiting, Willoughby, Ohio, assignors to The American Steel and Wire Company of New Jersey, a corporation of New Jersey.

✦ ✦ ✦

More specifically, the invention resides in a dual-speed power-transmitting mechanism for rotating a wire drawing block.

✦ ✦ ✦

Dictionary of Engineering and Machine Shop Terms

COMPILED in this handy volume are the definitions of many important terms used in machine shops, industries and engineering literature, as gathered by the author, **A. H. Bandy,** during many years of experience both in industry and as a lecturer.

✦ ✦ ✦

ITS clear and simple language will make this dictionary useful not only for engineers and students of engineering, but also for foremen and specialized workmen of various shops and industries. It is published by the **Chemical Publishing Co.,** 26 Court St., Brooklyn, N. Y., contains 153 pages of text, and sells for $2.75 a copy.

Any Way You Figure It
Ingenuity Pays
You get more for your spool and reel dollar at Hubbard because of two things. (1) Continuous research and field work to find out what will work best. (2) Liberal use of ingenuity to adapt research developments for the improvement of Hubbard products.
Each type of Hubbard spool or reel for wire drawing, annealing, stranding and shipping is engineered to its job. All bring you the extra strength, long life and smooth running ability that help you reduce operating costs.
Write today for prices, delivery dates and details on Hubbard products or let our engineers help you solve special problems.
HUBBARD SPOOL COMPANY
1624 CARROLL AVENUE | CHICAGO 12, ILLINOIS
Since 1912, manufacturers of wire drawing and annealing, and shipping spools and reels.
PLANTS AT CHICAGO, ILLINOIS AND GARRETT, INDIANA

Outstanding Personalities of the Wire Industry

Jagielski Accepts Post in Mexico

WORD has been received that **Otto F. Jagielski,** Consulting and designing engineer of Worcester, Massachusetts, has accepted the post of Chief Engineer with **La Consolidada,** S.A., Mexico.

✦ ✦ ✦

MR. Jagielski was retained by this company, a large steel and copper plant, in a consulting capacity in 1944 and spent several months there assisting them in various problems related to plant layout, equipment and production. He is well known to our industry both as a consulting engineer and as a contributor of articles to WIRE AND WIRE PRODUCTS on subjects relating to electric wire and cable manufacture.

✦ ✦ ✦

OUR very best wishes go with him in this new connection.

✦ ✦ ✦

Join Eutectic Welding Alloys Company

C. F. Patterson has joined the field engineering staff of **The Eutectic Welding Alloys Company.** A native of Canada, Mr. Patterson will service Eutentic's customers in Michigan.

✦ ✦ ✦

JOHN A. Owen also has been added to the staff of the Company. A veteran welder, Mr. Owen owned and operated a welding and machine shop for 28 years. He will serve as Field Engineer for the state of North Carolina.

✦ ✦ ✦

W. J. Murray Joins Wickwire Spencer

THE **Wickwire Spencer Steel Company** has announced that **William J. Murray** has been appointed Assistant Sales Manager of the Fence Division.

✦ ✦ ✦

MR. Murray has many years experience in sales and service of chain link fence. For the past 15 years he has been in charge of the Eastern division of the Fence Department of the **Pittsburgh Steel Company.** Previously he was connected with **Cyclone and Anchor Fence Companies.**

✦ ✦ ✦

MR. Murray will make his headquarters in New York at 500 Fifth Avenue. For the present he will devote his attention to sales and service of chain link fence to all war and industrial plants. When war restrictions are lifted his services will be available in connection with the installation of chain link fence for its many normal peacetime uses.

(Please turn to page 214)

TECO Cemented Carbide wears slowly and smoothly because an intensely hard, uniformly dense structure provides greater resistance to friction in high-speed wire drawing. As a result, you get longer runs of smooth, on-size wire. Less time is lost in unproductive die changing. Costly reject runs due to pitting and cracking are eliminated.
Equipped with TECO Carbide Dies, your machines produce more tonnage per day, more tonnage per die, at lower cost. A test run offers conclusive proof. Let our engineers know your requirements.

WIRE and BAR DIES
SIZING DIES — EXTRUDING DIES
TUBING DIES
Carbide Blanks, Tools, Bits,
Reamers, Broaches, Forming Tools

TUNGSTEN ELECTRIC CORPORATION — 564 39th St., Union City, N. J.
Branch Office: 2906 Euclid Avenue, Cleveland, Ohio
Representative: Architects & Builders Bldg., Indianapolis, Ind.

TECO — Pioneers in Tungsten Carbides for over a Quarter Century — CARBIDE DIES

Outstanding Personalities of the Wire Industry

(Continued from page 213)

Made Manager of Crystal Division

WESLEY L. WILSON has been appointed Commercial Manager of the Quartz Crystal Division of **North American Philips Company, Inc.,** one of the large producers of quartz crystals for land, sea and airborne military communications. The Company is devoting considerable research and engineering experimentation to applications in military communications equipment. After the war the Company plans to continue the production of quartz crystals, tubes, fine wire, and other materials used in the manufacture of electronic equipment.

✦ ✦ ✦

William Hubeli Waldron

WILLIAM Hubeli Waldron, Vice-President and Director of the **John Waldron Corporation** of New Brunswick, N. J., died at his home here on February 1st in his 80th year. He had been associated with the Company since 1885, the Company having been founded in 1827.

✦ ✦ ✦

R. S. Hudgins has been appointed plant superintendent of **Kennametal Inc.,** Latrobe, Pa., succeeding **W. E. Newcomer,** resigned. Prior to his recent appointment, Mr. Hudgins was tool engineer and representative for **Latrobe** at West Hartford, Conn.

✦ ✦ ✦

Sieber to Bridge

NELSON W. Sieber, for 20 years advertising manager for **Continental - Diamond Fibre Company,** Newark, Del., has become associated with **The Harry P. Bridge Company,** Philadelphia advertising agency.

✦ ✦ ✦

HE will service the Continental-Diamond and Haveg Corporation accounts.

✦ ✦ ✦

ROBERT T. Dunlap, vice-president in charge of production, **Wickwire Spencer Steel Co.,** New York, has been elected a member of the board of directors.

Wickwire Spencer Appoints A. S. Rairden Wire Rope Sales Manager

THE Wickwire Spencer Steel Company has announced the appointment of **A. S. Rairden** as Sales Manager of the Company's Wire Rope Division.

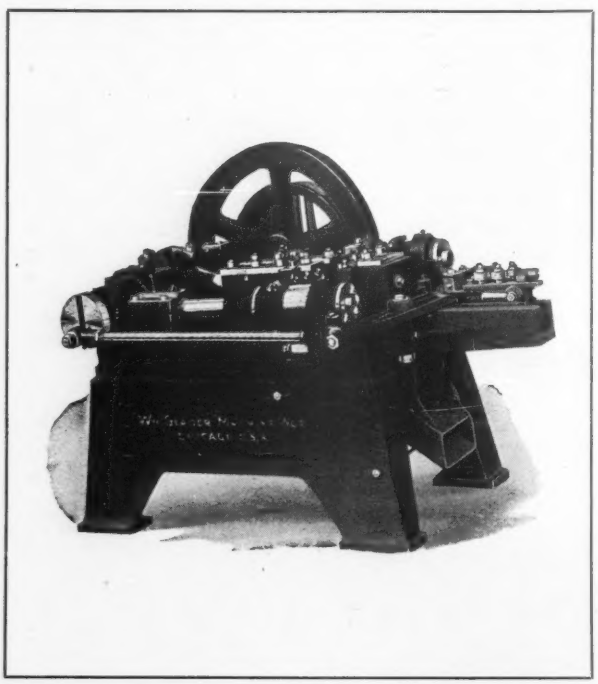
✦ ✦ ✦

MR. Rairden, well known in the steel industry, was previously with Carnegie Illinois, American Steel and Wire and American Chain and Cable. He was also associated with Wickwire Spencer for 10 years as Sales Engineer and Wire Rope Sales Manager.

✦ ✦ ✦

MR. Rairden is an outstanding authority on wire rope manufacturing and application techniques. As a member of the Manufacturers Committee he assisted in the preparation of Wire Rope specifications for the National Bureau of Standards and the Army and Navy Aeronautical branches. He is also the author of many articles and scientific treatises on wire rope application.

GLADER HIGH SPEED WIRE NAIL MACHINE



High tonnage output, and low maintenance costs, have resulted in Glader Machines being accepted as standard equipment in every large nail mill built in the United States in the past twenty years.

Glader Machines are operating in most of the wire producing mills throughout the world.

These machines are made in eleven different types and sizes. This enables us to cover the range of sizes of nails produced with the greatest efficiency.

For further information please address,

WM. GLADER MACHINE WORKS

210 NO. RACINE AVE.

CHICAGO, ILLINOIS

R. W. M. A. Elects '45 President

THE **Resistance Welder Manufacturers' Association** at their January meeting in Detroit have elected **Chas. Eisler** President of the R. W. M. A. for 1945. Chas. Eisler, owner and director of the **Eisler Engineering Co.**, Newark, N. J., succeeds **Floyd E. Taylor,** President of **Swift Electric Welder Co.,** Detroit, Michigan. Co-vice presidents are **David Sciaky** of **Sciaky Brothers** in Chicago, and **H. V. Beronius** of **Welding Machines Manufacturing Co.** in Detroit. Chas. Eisler has been building Resistance Welding equipment for a quarter of a century, this year marking the twenty-fifth anniversary of his organization.

✦ ✦ ✦

AS head of the R. W. M. A. which represents the bulk of the Resistance Welding Industry, Chas. Eisler guides both the organization and its purpose. Among the many activities are improved relations among members, high ethical standards for the industry, encouraging methods for greater economy and efficiency, product improvement, as well as new markets for Resistance Welding. The result has been many organizational activities and development of specification standards, standard practice and procedure, research and development, cooperation with other associations such as the American Welding Society, and joint studies with other Industries.

✦ ✦ ✦

SINCE the reorganization of R. W. M. A. in 1938, Chas. Eisler has been active in the organization in various capacities — advisory board, public relations committee, arbitration committee; last year he served as co-vice president with **W. T. Ober** of the **Thomson-Gibb Electric Welding Co.** of Lynn, Massachusetts.

✦ ✦ ✦

WHEN the full story of Resistance Welding is told after the war, this fifty year old art will take its heralded place among the many production tools which have helped to make the U. S. the Arsenal of Democracy.

✦ ✦ ✦

ANDREW E. **Kuby,** one of the founders of **Standard Steel & Wire Corp.,** Chicago, has been elected president and treasurer; **Eugene L. Rippel,** for the past eight years Chicago district manager for **Greer Steel Co.,** has been elected vice-president in charge of sales; **William A. Wade,** associated with **Steel Sales Corp.,** Chicago, for the past 18 years, has been made vice-president; and **Elmer C. Lundahl,** who has been with Standard since its inception in 1920 has become secretary. These officers also have been elected directors of the firm.

✦ ✦ ✦

A. **L. McNeill** has been appointed Chicago district manager of the Okonite Co., Passaic, N. J. **E. H. McNeill,** formerly manager of the power and light department, has been appointed assistant manager, Chicago district, and **Harry D. Pierce** has been made office sales manager.

(Please turn to page 216)

"Steelskin Brands"

Reg. U. S. Patent Office

WIRE, TUBING, STAMPING
DEEP DRAWING SOAPS AND COMPOUNDS

COPPER WIRE COMPOUNDS

"STEELSKIN" C.W., PASTE — For wet rod and intermediate machines — when used at 3% concentration it gives a very stable long-lasting emulsion with unusual film strength at high speeds.

"STEELSKIN" P.W.D., FLAKES — For finer sizes — when used at ¾% concentration it gives exceptional die life and very clean wire, adaptable to any subsequent coating as enameling, etc.

Back of the "STEELSKIN" TRADEMARK is a thirty-five-year period of experience in the development and manufacture of soaps and compounds for dry and wet drawing of all types of ferrous and non-ferrous wire.

OUR ENGINEERS WILL BE GLAD TO COOPERATE WITH YOU IN FINDING THE MOST ECONOMICAL AND EFFICIENT SOLUTION TO YOUR DRAWING PROBLEMS.

Write or phone. Tel. NO. HOMER 192.

R. H. MILLER COMPANY

HOMER, NEW YORK
Established 35 Years

Outstanding Personalities of the Wire Industry

(Continued from page 215)

Norton Company Announces Appointments

NORTON Company of Worcester, Massachusetts, announces the appointment of three additional vice presidents: **Milton P. Higgins, Ralph M. Johnson** and **Frank W. Smith.** Mr. Higgins continues as treasurer, and Mr. Johnson as general sales manager of the Abrasive Division.

MR. Smith, formerly sales manager of the Grinding Machine Division, is also appointed manager of that division succeeding **Howard W. Dunbar,** vice prsident, who is to continue to serve the company in an executive capacity. Mr. Smith has been with Norton Company for 26 years.

✦ ✦ ✦

OTHER Grinding Machine Division changes are: **Albert G. Belden,** formerly chief engineer, is to be manager of research and engineering; **Iver G. Freeman,** formerly superintendent, factory manager; **Roger Magoun,** formerly production engineer, production manager; and **C. Denson Day,** formerly assistant sales manager, sales manager.

✦ ✦ ✦

Form Technical Division

F. S. MacGregor, general manager, Electrochemicals Department of **E. I. du Pont de Nemours & Company,** announces the formation of a Technical Division with **Donald O. Notman** as director.

✦ ✦ ✦

IN the new division, **Dr. C. W. Tucker** will be chemical director **Dr. Sterling Temple,** who has been chemical director of the department, will be a special assistant to Dr. Tucker.

✦ ✦ ✦

ALL research and semi-works activities of the Electrochemicals Department will be coordinated in the new Technical Division, with headquarters in Wilmington.

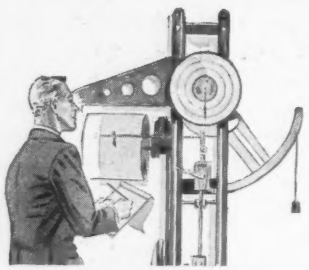
✦ ✦ ✦

New Association Formed Last Fall for Lubrication Engineers

LUBRICATION engineers representing prominent industrial and transportation companies and educators have organized a non-profit body known as the American Society of Lubrication Engineers, with headquarters at 135 South LaSalle Street, Chicago.

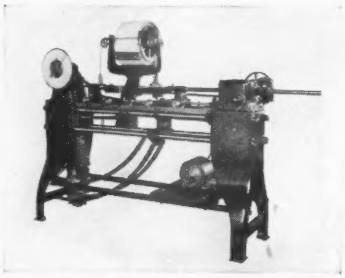
✦ ✦ ✦

A recent bulletin states that "lubrication engineers have felt for years the need of a national organization pertaining directly to their profession. Our objective is to put on a sound basis the fundamental precepts of lubrication, which we believe will be of benefit to all phases of industry with their many related problems . . . We also believe that the endeavors of our Society can be accomplished without conflict with or injury to existing engineering societies having lubrication sub-divisions."



TESTING helps speed Reconversion

An adequate testing routine gives you the Control that speeds all the steps in reconversion — purchasing, research, production, acceptance - inspection. The 60 models of *Scott Testers are standard for tests on wire and strip from finest filament to 1 ton for tensile, hysteresis, twist, flexing, compression - cutting of rubber covering, etc.



Model Q-7 Scott Tester. Heavy duty tensile tester for wire, with capacity for 2,000 lbs.

Request Bulletins

HENRY L. SCOTT CO.

55 Blackstone St. SCOTT TESTERS Providence, R. I.

*Registered Trademark

Scott Testers — Standard of the World

MEMBERSHIP is stated to consist of representatives of the educational field, machinery builders, lubricant suppliers and consumers as represented by the various phases of industry. The further aim will be "to promote the subject of lubrication in the various educational institutions to better prepare future members of industry for a more complete understanding of the operational problems to follow.

✦ ✦ ✦

OFFICERS of the American Society of Lubrication Engineers are:— C. E. Pritchard, Republic Steel Co., president; J. C. Peebles, Dean of Engineering, Illinois Institute of Technology, vice-president; B. H. Jennings, Professor of Mechanical Engineering, Northwestern University, secretary and treasurer. Directors include D. N. Evans, Inland Steel Co.; I. L. Harper, Lehigh Valley Railroad; and D. E. Whitehead, Carnegie-Illinois Steel Co.

✦ ✦ ✦

New Furnace Starting Coil Eliminates Salt Bath Freeze-Up Worries

FREEZE-UPS of electric salt bath furnaces no longer require extensive time in starting up when a new electric salt bath furnace coil introduced by Upton Electric Furnace Div., 7450 Melville at Green, Detroit 17, Michigan, to "un-freeze" Upton salt baths, is used.

✦ ✦ ✦

THE starting coil consists of a nichrome heating coil element connected to the output leads of the furnace transformer by two mild steel bars and flexible buses. No additional equipment is required and the time required to place the coil in operation is negligible.

✦ ✦ ✦

THE coil can be used either before or after the salt in the furnace is allowed to freeze up. When the furnace is to be shut down, the coil is dropped into the salt bath so that it reaches the bottom of the pot. The power can then be cut and the furnace allowed to freeze up. The leads are connected to the transformer and the power turned on when it is desired to start the furnace again. With both the starting coil and the normal heat from the electrodes, the salt is melted down in a short time, and the starting coil removed and the furnace is ready for use.

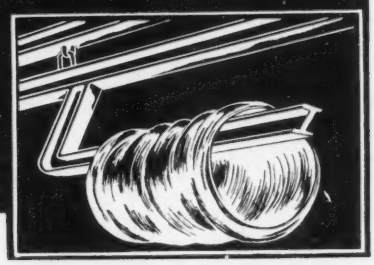
✦ ✦ ✦

WHEN the salt has been allowed to freeze up solid without the starting coil having been placed in the bath, the salt at the top of the pot is chipped away to provide a nest for the coil and the starting coil placed in the nest as illustrated. Loose salt is poured into the depression and around the coils until the latter are about half covered. The leads of the starting coil are connected with the transformer and the power turned on.

✦ ✦ ✦

MELTING of the salt from this point on is entirely automatic. As the salt at the top melts, the coil works downward, melting the frozen salt as it descends until the salt in the pot is completely molten.

NEW Coating Technique For Rods and Wire to Help SPEED Production



OAKITE CrysCoat PROCESS

This new development, already successfully used in a number of mills, produces a phosphate coating on ferrous rods and wire that results in many advantages and economies in drawing. Employing a new material known as Oakite CrysCoat No. 86, the process is simple in application . . . and inexpensive.

Die Life Lengthened!

Rods or wire immersed in the recommended solution of Oakite CrysCoat No. 86 acquire a non-hydroscopic, ductile, crystaline coating of fine grained structure. This coating combines CHEMICALLY with the surfaces treated. It serves to interpose between the metal and the die a tenacious parting layer which acts as an added lubricant for the die.

In addition, the crystalline coating has the property of adsorbing the usual die lubricants and of retaining them. Because of this, die life is considerably lengthened.

Further Data FREE On Request

Advantages known to result from the application of the Oakite CrysCoat Process are increased production, uniformly excellent appearance of wire, shorter down-time of equipment because necessity for replacing or changing dies is far less frequent. Mill superintendents interested in this NEW Oakite coating technique are invited to send for further details. Or production tests will be arranged for at your convenience.

OAKITE PRODUCTS, INC., 52 A THAMES STREET, NEW YORK 6, N. Y.
Technical Service Representatives in All Principal Cities of the United States and Canada

OAKITE MATERIALS METHODS SERVICE — Buy Bonds for Victory — CLEANING FOR EVERY CLEANING REQUIREMENT

Production Increased 200% with Automatic Cable Reel Boring Machine

THIS reel borer shown operating in the factory of the **New England Reel & Lumber Co.**, Pawtucket, R.I., has amply demonstrated its productive capacity for boring holes in cable reel heads.

✦ ✦ ✦

ACCORDING to **Mr. Fairhurst,** plant manager, they increased their reel boring production 200%.

✦ ✦ ✦

"I have seen and personally operated all types of reel boring machines," he said, "but there is nothing to compare with the Root Reel Head Boring Machines."

✦ ✦ ✦

AT one time during a rush order for reels, this company bored seven 36" reel heads per minute. The reel heads were spruce and white pine. Six bolt holes and one large center hole were bored in each reel head.

✦ ✦ ✦

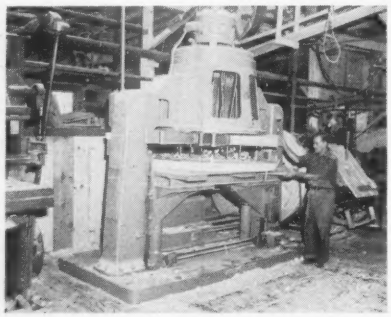
THE machine shown is a double column style with a hydraulic table feed mechanism. This type of table feed control assures a high degree of control over the table motion at all times. For instance, by means of the foot controls, shown next to the operator, he is able to start, stop or reverse the motion of the table at any point of the feed or return stroke. Furthermore, the number of strokes per minute may be varied as desired up to a maximum of 35 strokes per minute.

THE boring spindles are of the gear driven universally adjustable type. They may be moved about to conform with an almost endless variety of boring patterns. Thus when the cable boring spindles are arranged for a particular job, the entire reel is bored in one operation.

✦ ✦ ✦

ONE type of job does eight bolt holes and a large center hole bored with one movement of the feed table.

✦ ✦ ✦



Reel Head Boring Machine

THE machine shown will accommodate reel heads with a maximum diameter of 72". The maximum boring diameter is 40" and the minimum boring diameter is 5". The maximum number of adjustable spindles this machine will accommodate is 27. The spindle speed is 1800 r.p.m. For boring very large center holes a heavy fixed spindle is furnished.

THIS machine is a product of the **B. M. Root Co.** of York, Pa., who for many years have specialized in the design and manufacture of production boring machines of all types.

✦ ✦ ✦

THEIR latest contribution to this class of machinery is the line of hydraulic feed cable reel boring machines.

✦ ✦ ✦

THE double column 72" style AM-RH is shown here. A larger machine recently manufactured had a maximum boring diameter of 50" and a reel diameter of 84".

✦ ✦ ✦

SMALLER cable reel boring machinery includes a single column borer with a 27" maximum capacity.

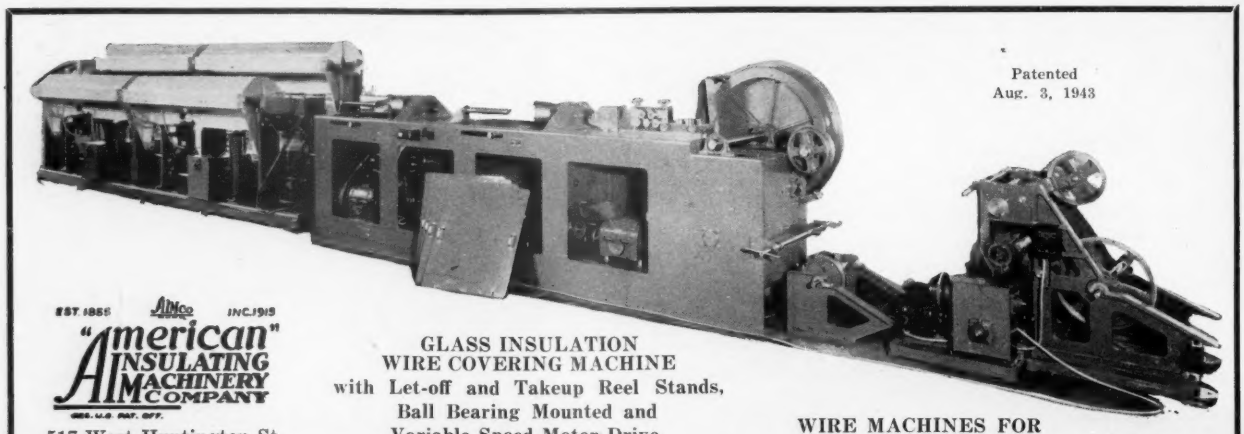
✦ ✦ ✦

THE Root Company advises that illustrated literature on their cable reel boring machinery is available upon request from any interested party.

✦ ✦ ✦

Beryllium Copper Alloy Qualities Described in Catalogue

THE **Beryllium Corporation of Pennsylvania,** Reading, Pa., has just published a catalogue giving considerable information of both a technical and practical nature on the casting characteristics of beryllium copper, including physical properties, recommendations on heat treat-



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Aug. 3, 1943

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517 West Huntington St.
Zone 33
PHILADELPHIA PENNSYLVANIA U.S.A.

GLASS INSULATION
WIRE COVERING MACHINE
with Let-off and Takeup Reel Stands,
Ball Bearing Mounted and
Variable Speed Motor Drive,
Baking Ovens with Two Coat Varnish
Applicators, and Individual
Automatic Temperature Controllers.

WIRE MACHINES FOR
Drawing, Enameling, Tinning, Spooling, Insulating with Glass, Asbestos, Paper Tape, Cotton, etc. Multiple Pullouts, Rubber covered wire Panners, etc.

ment, machining practice and descriptions of parts that have been made from this metal in the past year where no other metal was satisfactory.

✦ ✦ ✦

AS nothing has heretofore been published on the casting properties of these alloys, this catalogue will be of value to those interested in this metal. A list of the types of products that can be made of beryllium copper is included.

✦ ✦ ✦

PLEASE write the Company, if a copy of this booklet is desired.

✦ ✦ ✦

Publishes Bulletin on Steam Condenser

A new single page bulletin with holes punched for binding, has been printed by the **Niagara Blower Company,** 673 Ontario St., Buffalo 7, N. Y. It is a diagram of their new product, the Aero Steam Condenser, with the flow of air, steam, spray and condensate indicated in color to show the operation of this piece of equipment. A copy will be mailed upon request. Ask for Bulletin #99.

✦ ✦ ✦

Bulletin Describes New Straightening and Cutting Machines

A new four page folder describes a redesigned and improved line of straightening and cutting machines manufactured by the **F. B. Shuster Mfg. Cimpany, Inc.,** New Haven, Conn., who have been making this type of equipment since 1866.

✦ ✦ ✦

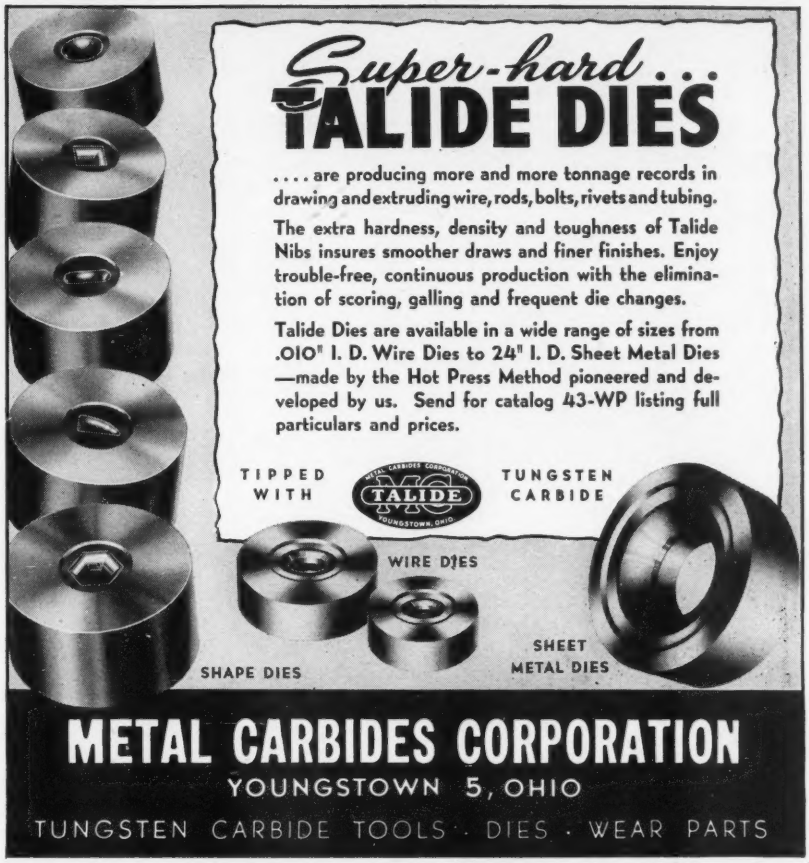
THE line covered embodies five models capable of handling stock from 1/32" up to 11/16" diameter. The larger machines are equipped with variable speed units which afford a wide range of speed for feed and cut-off.

✦ ✦ ✦

THE mechanical features are fully described and the different models illustrated.

✦ ✦ ✦

COPIES of the folder will be sent by the Company to interested parties upon request.


Super-hard . . .
TALIDE DIES
. . . . are producing more and more tonnage records in drawing and extruding wire, rods, bolts, rivets and tubing.
The extra hardness, density and toughness of Talide Nibs insures smoother draws and finer finishes. Enjoy trouble-free, continuous production with the elimination of scoring, galling and frequent die changes.
Talide Dies are available in a wide range of sizes from .010" I. D. Wire Dies to 24" I. D. Sheet Metal Dies —made by the Hot Press Method pioneered and developed by us. Send for catalog 43-WP listing full particulars and prices.
TIPPED WITH
TALIDE
TUNGSTEN CARBIDE
WIRE DIES
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TUNGSTEN CARBIDE TOOLS · DIES · WEAR PARTS

40 MILLIONTHS
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OF AN INCH
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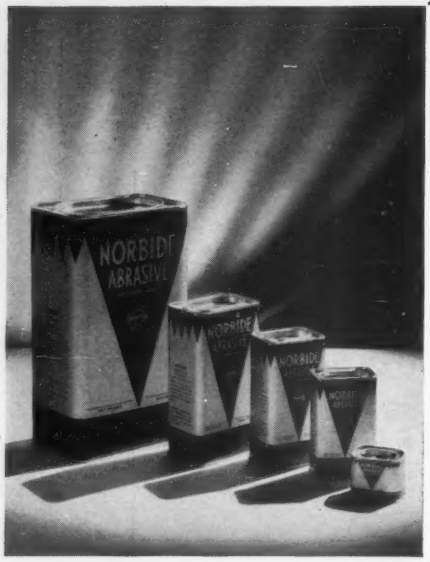
MAINTAINED BY 4-HIGH
"Standard" ROLLING MILL
EXTRA PRECISION 4-HIGH LIGHT DUTY MILL
2, 3 or 4 High "Standard" Mills built to specific customer requirements for —
1. Hot and cold rolling of metal strip, rod and ingot
2. General sizing and embossing
3. Precision rolling of strip
4. Grading
5. Cross and pinch rolling
6. Forming of wire to exact dimensions
7. Single or tandem rolling
Roll sizes range from 1½" diameter and 1" face to 16" diameter and 18" face. Speeds may be provided from 10' to 500' per minute. Attachments include running-in tables, single, double and triple edgers, payoff reels, takeup reels, straighteners and Turks Heads.
WRITE FOR CATALOG SECTION RM
STANDARD MACHINERY CO., 1545 Elmwood Avenue, Providence 7, R. I.
Export Department: 1111 South Ferry Bldg., New York 4, N. Y.



NORBIDE Abrasive
For Wire Drawing Dies
Cuts Costs 100%

NORBIDE Abrasive is extensively used as a successful medium for cutting and semi-finishing cemented carbide wire drawing dies. NORBIDE is second only to the diamond in hardness yet the abrasive costs but one hundredth as much as diamond powder. In the cutting and finishing of wire drawing dies sizes 220 and 240 are used for ripping, 320F for a semi-polish, 500 to 800 for final finish.

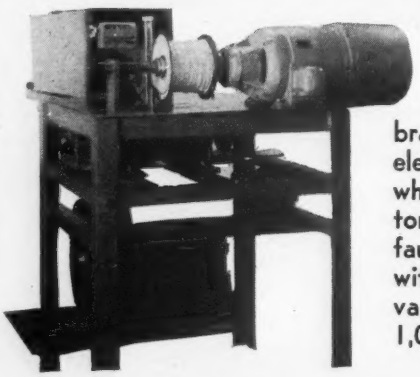
NORBIDE is the registered trade-mark of Norton Boron Carbide

NORTON COMPANY - - Worcester 6, Mass.

NORBIDE *ABRASIVE AND MOLDED PRODUCTS*

SPARKER for SPOOLING
SMALL WIRES

THIS APPARATUS WILL AUTOMATICALLY STOP WHEN DIELECTRIC FAULT OCCURS, or when the machine has wound a predetermined length of wire.



It is equipped with a gear head motor, electrical brakes on take-up and pay-off, electrode, control apparatus which automatically reduces the torque of the motor in starting, fault light indicator, transformer with tap switch, volt meter, and variac. Range of voltage from 1,000 to 16,000 volts.

Please Address Inquiries To:

R. L. DAVIS ELECTRIC CO., INC.

WALLINGFORD, CONN.

Design Progress in Aircraft Electric Equipment

G-E engineers, at a recent meeting of the AIEE discussed advances made in electrical equipment for aircraft. Among those items considered was ignition cable.

✦ ✦ ✦

RESULTS of an investigation of the failure of aircraft ignition cables and connectors at high altitudes, along with several means by which the life of the ignition system may be extended appreciably, were presented in a paper by **H. H. Race, General Electric** research engineer of Schenectady, and **A. M. Ross, Jr.,** chemist in the Company's Bridgeport Works Laboratory.

✦ ✦ ✦

THE authors described a simulated-altitude test equipment devised especially for the investigation, declaring that it exposed weaknesses not so readily understood or remedied otherwise. Superiority of neoprene-sheathed over lacquered-braid cables was conclusively demonstrated by the tests, according to the authors. They attributed the superiority to three major factors:

First, elimination of the cotton braid common to lacquered-braid cables; second, inherent heat and ozone resistance of neoprene; and third, construction of the neoprene-sheathed cable is better suited to proper sealing of the spark plug well, a necessity revealed by the tests.

✦ ✦ ✦

DEVELOPMENT of new insulating materials or new cable or connector constructions can be accelerated through simulated-altitude testing, according to the authors. However, they cautioned that it should not be regarded as a substitute for acceptance or manufacturing control, but rather as an adjunct to them. Its most valuable function is to give information on newly designed assemblies in advance of actual engine tests, they said.

✦ ✦ ✦

AN improved terminal construction which materially reduces the number of arc-over failures was described by the authors as another result of their investigation. The terminal is designed for five-millimeter cables, with its neoprene adapter boot, grommet, and mycalex termi-

nal sleeve molded integrally. A copper ring washer molded into the grommet provides good electrical contact for radio shielding and relieves the neoprene of abuse caused by cycling of temperature or inspection and servicing.

✦ ✦ ✦

G-E Engineers Duplicate Tropic Humidity in Insulation Tests

HUMIDITY conditions worse than those reported by the India Meteorological Department for Rangoon, India, where the air is often saturated with moisture, were duplicated in tests devised in a **General Electric** laboratory as a means of combating the ravages of electrolytic corrosion on insulating materials in the tropics. The tests were described by **B. H. Thompson** and **K. N. Mathes** of the Company's General Engineering Laboratory during the AIEE Winter Technical Meeting at New York.

✦ ✦ ✦

IT was stated that a large proportion of failures caused by moisture in apparatus containing fine wire is due to electrolytic corrosion, and that the destructive effect occurs when moisture absorption produces leakage currents which electrolytically decompose the conductor and result in open rather than in shorted windings. No class of materials has yet been found which is completely noncorrosive, and the corrosive nature of various insulating materials differs widely. In some cases a single class of materials may even possess a wide range of corrosion-inducing characteristics.

✦ ✦ ✦

IT was indicated that tests such as they made can be of value in the design of aircraft equipment, which may be exposed to high humidity conditions even though not used in the tropics. Even in temperate climates moisture condensation may occur on apparatus chilled during aircraft flight at high altitudes. This water may be forced into electrical windings by pressure changes resulting from subsequent changes in altitude, serious damage may occur if this absorbed water freezes and cracks the insulation. The three types of tests described were a visual test, a corrosion current test, and a water extract test.

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GILRON COATING COMPOUNDS

A big step forward in wire drawing. Thoroughly proven in mill practice. Makes possible wire drawing speeds heretofore considered impracticable. Increases die life, prevents scratching of wire, produces better finish and eliminates use of lime in many cases.

These coating compounds are of particular value in the more difficult operations—stainless, alloy, high carbon and welding rod wire. Multiple reductions can be drawn without re-coating.

Coatings for Drawing Stainless, Alloy, Low and High Carbon and Copper Coated Wires

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TUNGSTEN CARBIDE DIES for HEADING and

WIRE AND TUBE DRAWING (.030" to 2"), EXTRUSION (1/16" to 1"), RECUTTING AND WELDING ELECTRODE COATING.

RING GAUGES
DIAMOND DIES (.0015" up)
DIAMOND POWDER IN ALL GRADES

AIRCRAFT EXTRUSION DIES

As a special service to customers, we are prepared to give three day service on standard wire, tube and extrusion dies in cases of extreme urgency.

Address Inquiries to

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NEW — AND BETTER

PATENTING
TEMPERING
ANNEALING

The Trauwood PROCESS

OUTSTANDING ADVANTAGES

Higher and more uniform physical and fatigue properties.

No surface decarburization or scale. Faster wire speeds . . . greater production.

Equipment fully automatic and easy to operate.

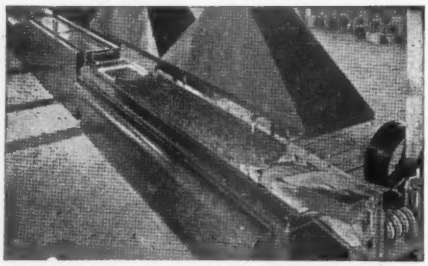
Control of heating and cooling cycles extremely accurate.

Thermal efficiency of the process very high.

Much finer grained structure possible.

High quenching temperatures rapidly attained.

Adaptable to high alloy and austenitic steel wire and strip (annealing of stainless).



Trauwood Electric Wire Tempering and Patenting Unit

The Trauwood Process, new in priniiple, eliminates high temperature furnaces and lead pots with their excessive maintenance costs and low thermal efficiencies. More positive temperature control is possible and quenching is done in a RISING temperature—instead of falling, as in conventional heat treating methods. The rapid rate of heating (4 to 5 times as fast as furnace heating) increases production and uniformly produces a finer grained product with higher physical and fatigue values.

Wire and rod patented by the Trauwood Process insures easier drafting and makes heavier reductions possible. In conjunction with the Trauwood patenting equipment, pickling, coating and baking can be made continuous, eliminating expensive handling and delay, materially reducing costs as compared with ordinary methods.

Complete details of the Trauwood Process will be furnished you on request. Our engineers will help you solve your continuous wire and strip patenting, tempering, and annealing problems. Write today.

THE TRAUWOOD ENGINEERING COMPANY

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LIQUIDATION SALE

JERSEY STEEL & WIRE CORP.

84 COIT STREET, IRVINGTON, N. J.

All of the assets of the above-mentioned corporation available for immediate purchase. These include:

Ryan Industrial Continuous Type Furnace
Gehring Drying Furnace
Wire Drawing Machines
Olsen Testing Equipment
Stock of Carboloy and Diamond Dies
Lapping Machines
Stock of Stainless Steel and Music Wire
and Many Other Items of Machinery and Equipment

Sale will proceed daily from 9 a.m. to 5 p.m. through March.

Telephone on Jersey Steel & Wire Corporation's Premises:
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PUBLIC SALE COMPANY
115 Market Street
PATERSON, N. J.

Stainless Steel Mentioned As Possible Rival to Nylon for Hose

AT a recent meeting of the Association of Customers Brokers in New York, **Walter Tower,** President of the **Iron and Steel Institute** told his audience that the metallurgical laboratories of the leading steel companies were experimenting with stainless steel hosiery to compete with material silk and nylon in the post-war era. Stainless steel wires, he pointed out, were now being made in sizes comparable to nylon and silk threads.

✦ ✦ ✦

AMONG other things that are future possibilities are colored steels, which would eliminate the need for costly paint jobs. Mr. Tower expressed the belief that plastics would not seriously compete with steel, but would supplement them and in the long run help the sale of steel rather than retard it.

✦ ✦ ✦

Brochure Describes New Laboratory

THE **J. O. Ross Engineering Corporation,** 250 Madison Avenue, New York, 17, New York, have just published a brochure describing their new laboratory at New Brunswick, N. J.

✦ ✦ ✦

AN interesting feature of this laboratory is that instead of being equipped for small-scale experiments, in which so many errors can occur, equipment is of such size as to permit of commercial tests on a scale approximating actual field operating conditions. While it is not the object of the **Ross Laboratory** to engage or assist in purely development work, it can prove of immense value to industrial concerns seeking to detemine the most efficient methods of processing.

✦ ✦ ✦

COPIES of this brochure may be had by anyone interested in learning more about the facilities offered by the Laboratory, upon writing the Company at New York or any of its branch offices in Chicago, Detroit or Boston.

Issues New Catalog

THE **Dobeckmun Company,** 3301 Monroe Avenue, Cleveland 13, Ohio, manufacturers of Kexel insulating tape, and other products, have issued a strikingly handsome new catalog entitled "Applied Magic—101 Adaptations of Films and Foils."

✦ ✦ ✦

IN this book is described Lexel, a cellulose acetate butyrate film used widely as a primary winding on communication and hook-up wire. In tape form it is wound directly on the wire.

✦ ✦ ✦

THE edition of this catalog is limited and available to executives who may direct their inquiries to the Cleveland headquarters at the address above.

✦ ✦ ✦

Eutectic Publishes New Data on Maintenance Welding

FROM **The Eutectic Welding Alloys Co.,** 40 Worth St., New York 13, N. Y., comes the announcement that they have just brought out a six-page folder on their **Low Temperature** Welding rods, concentrating on the problems which concern maintenance.

✦ ✦ ✦

FOR plants and their welders, the new folder describes **Eutectic's** exclusive procedures fully, in which their rods, applied at low temperatures to cast iron, steel, aluminum, bronze, etc. produce clean, strong bonds yet leave the welded part easily machinable. There are many suggestions for salvaging parts which were thought ready for the junk pile . . . and putting them to work again.

✦ ✦ ✦

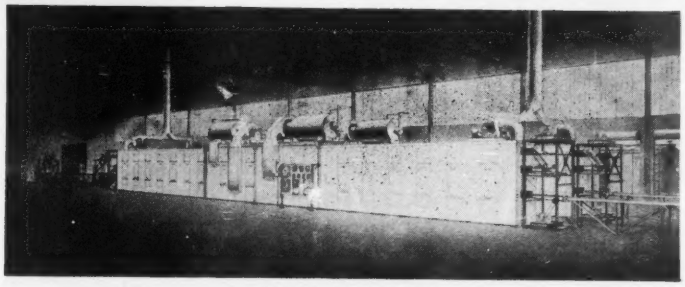
Zinc Again to Be Placed Under Allocation

ZINC will shortly join the lengthening list of metals that will again be placed under allocation because of increasing war requirements, War Production Board says. Zinc went off allocation on September 15, 1944. The new regulations are expected to follow closely the previous allocation order.

MORE PRODUCTION IN LESS TIME with CARL-MAYER FURNACES, OVENS

CARL-MAYER HI-SPEED
ROD BAKER

The fastest rod baker built! Saves up to 50% in time and fuel. Patented Blow-Off Feature removes moisture without bumping or agitating the coils. **Patented and patents pending.**



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For drying coated welding rods. Uses the "Mayer" Recirculating Gas Fired Air Heater principle and Rod Transfer Systems (patents pending).

Growing interest in our type of equipment is evidenced by Carl-Mayer installations in such plants as:—

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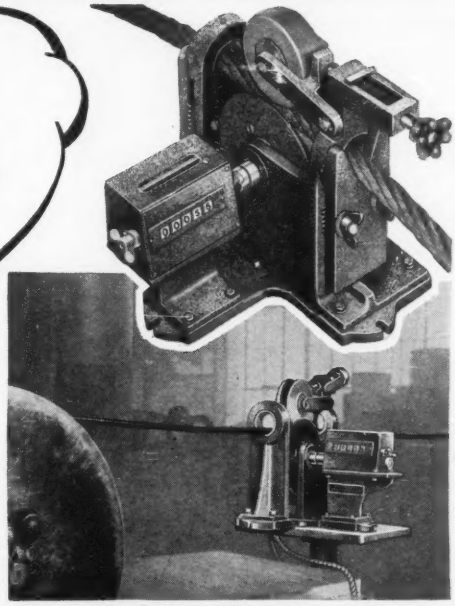

to install
PRODUCTIMETERS

Now, when greater production is demanded from every machine in the wire industry! Productimeter Wire Measuring Units give accurate lineal measurement in feet . . . speeds 500 to 5000 ft. per minute . . . built for an exact purpose, they'll stand up under long, hard usage. You can depend upon them to supply the figures and facts for efficient production control.

L-20 Wire Measuring Unit
Installation: position "A". Above: position "C".

The line includes units for various wire measuring requirements . . . for different types of material . . . insulated cable, bare wire, rope, chain, braid. If you have an immediate problem write us for recommendations.

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Apco Mossberg Steel Reels are standard throughout the wire industry – and for good reason! Apco Mossberg – the original Frank Mossberg Co. – *originated* the steel reel idea and have been training workmen in their manufacture ever since. That is why Apco Mossberg Steel Reels are preferred where the pressure of wartime production schedules is heaviest.

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We will gladly submit drawings, blueprints, or suggestions without obligation to you. Write for quotation today.

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(The Original Frank Mossberg Co.)
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WIRE CUTTING and SHAPING MACHINES, FINE WIRE WELDERS

We make Spot Welders from ¼ to 500 KVA & all Types Butt Welders

Automatic Drawing and Cutting Mach.

Eisler fine wire cutting and forming machines have been in use over twenty-five years.

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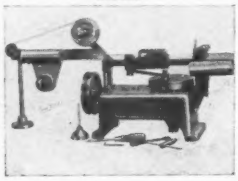

Bench Type Butt Welder

Spot Welder

CHARLES EISLER

EISLER ENGINEERING CO., 747 So. 13th St., near Avon Ave., Newark 3, N.J.

The War Production Board Reports on Diamond Dies

SMALL diamond dies, used to draw millions of miles of filament and resistor wires for wartime electronic equipment, are now precision-made by American workers. New scientific methods are used in diamond die production instead of hand-drilling and laborious polishing done previously by French and Netherlands craftsmen.

✦ ✦ ✦

LATEST electronic developments depend on "invisible" wires drawn at high speeds through precisely drilled diamonds. Metal strands are drawn at high speeds through miscroscopic channels, producing wires some of which are finer than eight ten-thousandths of an inch in diameter.

✦ ✦ ✦

EVERY "walkie-talkie", the radio and communications system for every tank, jeep, bomber, fighter plane, PT-boat, submarine, destroyer, cruiser and battleship requires platinum, nickel-chrome, copper, aluminum, steel, molybdenum or tungsten wires drawn through diamond dies. The wires are fashioned into resistors, lamp filaments, grids for midget vacuum tubes, even photoflash bulb "fuzz," often finer than spider-web threads.

✦ ✦ ✦

MISCROSCOPIC drilling through rough 1/5-carat diamonds provide the mirror-finish channels through which metals of various compositions must travel at high speeds, without breaking, to produce the critical wires demanded by war needs. Invisible to the naked eye, the resultant superfine wires are used for electronic devices, or even woven into a "cloth" utilized in the manufacture of high explosives.

✦ ✦ ✦

NEW electro-mechanical methods of drilling diamonds, perfected by scientists under WPB auspices, are being adopted by die manufacturers with a remarkable decline in die costs and increasing quality and quantity of superfine wire production. Important new discoveries point to diamond die production in six man-hours against even the present record of 20 man-hours per die, officials of WPB's Miscellaneous Minerals Division reported.

✦ ✦ ✦

"THE great future of small diamond dies is linked with electronics" Athos D. Leveridge, chief of the Diamond Die Section of WPB, stated. "Use of electronics in many phases of warfare will be transplanted to civilian uses. Tremendous civic, medical and civilian demands for television and miniature radios will pyramid both in variety and quantity. 'Peanut' electric light bulbs are used in aircraft and medical apparatus. Flash bulbs are used in photography. Together with communications equipment and other military apparatus now on every war front, they are dependent on superfine wires, drawn through small diamond dies. The efforts of the War Production Board and associated governmental agencies already assure the quality of the dies that will draw the wires for those vast requirements of the future."

✦ ✦ ✦

PRIOR to 1939, our minor requirements for small diamond dies were filled by hand craftsmen in France and the Netherlands, working in their "cottage plants." Their skill in drilling diamond dies for drawing filaments of gold, silver, bronze, lead, etc., for weaving into gold braid, embroidery and ornaments, was passed on from generation to generation. After 1939, diamond die imports stopped.

✦ ✦ ✦

DEMANDS for huge quantities of fine wire, principally for electronics, forced the Office of Production Management, and its successor the War Production Board, to search for and provide diamond dies in the critical sizes to draw super-fine wires.

✦ ✦ ✦

DIES in America were "frozen." Some were made available to us by Allied Governments and industrialists. Thousands were gathered into a Government stockpile, from which they were allocated to wire manufacturers filling orders for top military requirements. WPB Conservation Order M-181, issued in July 1942, safeguarded the meager stocks of dies.

WIRE CUTTING
MADE EASY

Hard wire*, spring wire, as well as soft wire, wire fabric, tie wire, fencing, etc. — easily and quickly cut with a porter tool. A standard model for average needs. Special models for special work.

Send for catalog showing all Porter models of wire cutters, bolt clippers, etc.

*(with center cut round edge jaws)

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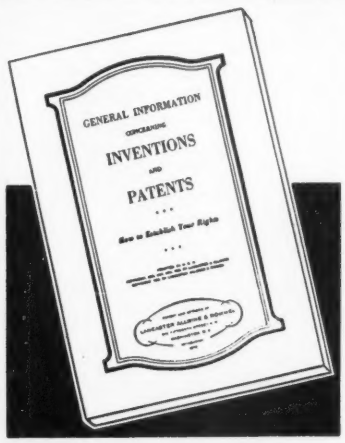
PORTER HKP CUTTERS



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SEARCHES were made for the few artisans in America and also European refugees who could drill diamond dies. Tools were scarce, but several small shops were soon built around skilled men and women who could produce diamond dies. The older workers also taught young men and women to work with microscopes. Steady nerves and patience are necessary for watching steel needles, one-sixth the thickness of human hair, drill for hours through specks of diamonds scarcely larger than pinheads. Besides the bell-shaped mouth on one end, and a hollow at the other end, the connecting channel has to be polished with diamond powder to perfect contours and mirror finish.

✦ ✦ ✦

LATE in 1941, W P B sponsored a plant, established on the Old World pattern, and manned by the Brenons, a family of French refugees. They pioneered the infant American diamond die industry and labored under conditions closely resembling those of their homeland. However, this cottage plant could not bring production up to scheduled proportions nor serve as a model for American firms to follow.

✦ ✦ ✦

ORGANIZATION of a diamond die unit within the Miscellaneous Minerals Division of WPB aided the production step-up required for our vast die needs. Government-sponsored and private firms refined large-die multiple-spindle drilling methods until greater speed in manufacture and use of less personnel resulted. Automatic processes were installed wherever possible.

✦ ✦ ✦

PERFECTION of die-drilling machines also considerably extended the lives of dies. Instead of drawing only two pounds of wire, equivalent to 200 miles, 25 pounds of wire were drawn through some new dies, producing, in exceptional cases, 2,500 miles of superfine wire. Shortly after Government die projects were initiated in late 1941, production stood at 1,200 dies per year, or 100 per month.

✦ ✦ ✦

TOTAL contribution of all domestic die producers in April 1942

(Please turn to page 226)

FOR MAXIMUM "MILEAGE" AND FINISH CONTROL IN YOUR WIRE DRAWING OPERATIONS USE P&G SOAPS

For drawing both ferrous and alloy wires — in either dry or wet operations — you can depend upon these important qualities in Procter & Gamble soaps:

Excellent Adherence
Efficient Lubrication
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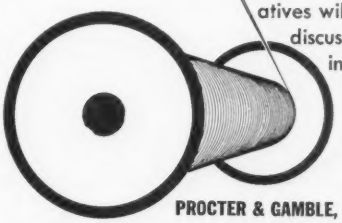
One of our representatives will be glad to discuss wire drawing lubricants with you.



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ACID PROOF
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Consulting and Research Engineers

750 ROCKEFELLER BLDG.
CLEVELAND, OHIO

The WPB Reports on Diamond Dies

(Continued from page 225)

amounted to approximately 320 dies per month of the superfine sizes. Qualities of these ranged from good to very poor or worthless. Careful WPB "nursing" and cooperation between the War Manpower Commission and Selective Service officials to provide or retain trained personnel lifted small diamond die production to an annual rate peak of 30,000 in late 1943.

✦ ✦ ✦

PROGRESS in the improvement of die life and quality, plus economical and greater wire-drawing capacities, was evidenced in the six months ended October 1, 1944. During this time 10 per cent more wire was produced than in the comparable period of 1943. Furthermore, only 58 per cent of the number of dies were used to do the job, representing an improvement of about 100 per cent.

ABOUT 17,000 of the critical sizes —with orifices fifteen ten-thousandths of an inch and smaller—were produced in 1944.

✦ ✦ ✦

TODAY, the small diamond die industry is on the threshold of inexpensive commercial drilling of diamonds to proper contours, through assistance of electric sparks. This new method was developed in research by the National Bureau of Standards and by prominent mineralogists and physicists in industry, under the sponsorship of the Diamond Section through the WPB Office of Production Research and Development and the War Metallurgy Committee of the National Academy of Science. The process promises highly significant results; finer dies at lower prices may soon be available to the wire drawing industries as a result of American ingenuity superimposed on Old World methods.

✦ ✦ ✦

THE actual drilling operations on dies — the most time-consuming factor—required large expenditures of manpower and wages. Such processes held dies at prohibitive costs in the United States, even in peacetime. However, electrolytic pre-drilling of diamonds, developed recently by WPB and collaborating scientists, may bring the critical product into lower price ranges for better dies.

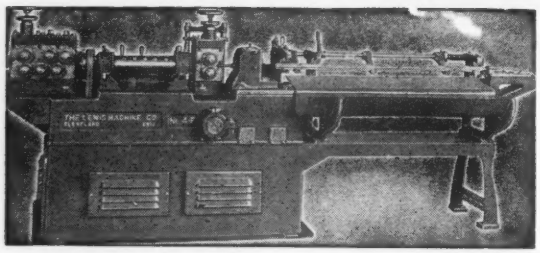
✦ ✦ ✦

THE pre-drilling operation consists of shooting an electric spark into a diamond from a platinum needle while both are immersed in a chemical solution. Such action drills or "burns" a microscopic cone in the diamond, which subsequent polishing forms into a finished diamond die.

✦ ✦ ✦

THE diamond die industry was also provided with new methods of producing and grading diamond powder, through the efforts of WPB and the National Bureau of Standards, under the same diamond die research project. Diamond powder is required in polishing the dies and dressing of industrial tools that produce precision parts for tanks, aircraft, submarines, torpedoes, battleships—indeed, every important element of our gigantic war machine.

LEWIS TRAVELCUT WIRE STRAIGHTENING and CUTTING Machines



Machines for 1/16" to ¾" rod
Round
Square
Flat
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Ferrous and Non-Ferrous

Automatic
High Speed
Heavy Duty

The Sign of Dependable Service:
WE CAN SUPPLY AND ENGINEER OUR TOOLS EQUIPPED WITH CARBOLOY CEMENTED CARBIDE

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HEAT EXCHANGER

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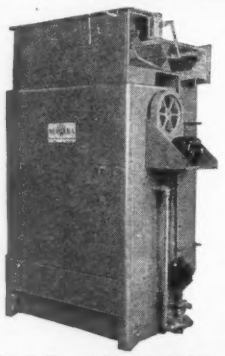
SALES ENGINEERS IN PRINCIPAL CITIES



U. S. Patent Nos. 2,296,946, 2,321,933 & Re-issue No. 22,553.

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DIE MACHINERY

LAPPING MACHINES
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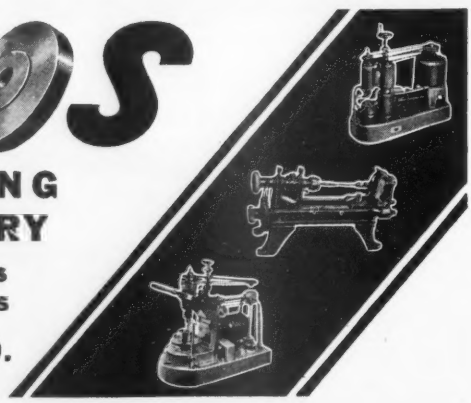

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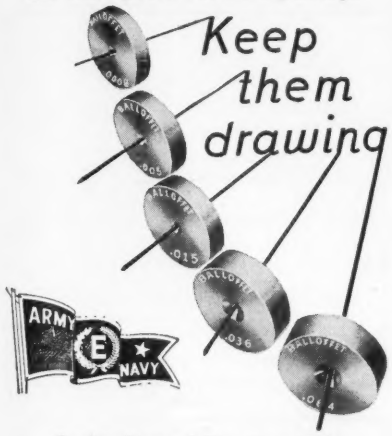
DIAMOND DIES

Balloffet's efficient bearing . . . Preselected stones—highly polished surfaces . . . overall quality plus skillful workmanship assure greater wire drawing mileage.



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PERSONS identified with domestic small diamond die production in various governmental capacities are:

✦ ✦ ✦

RICHARD J. LUND, director, Miscellaneous Minerals Division, now director of basic research for the Reynolds Metal Company; Alexander Shayne, of New York and Philadelphia, technical consultant on Navy and other projects; Dr. C. K. Leith, now chief of the Metals and Minerals Branch of the Office of Production Research and Development, WPB; John J. O'Rourke, until recently the field production representative for the Diamond Die Section of WPB; Athos D. Leveridge, chief, Diamond Die Section of WPB; F. G. Rockwell, now deputy director, Miscellaneous Minerals Division of WPB; and Dr. C. B. Slawson; H. Whittaker, Charles Schneider, H. Insley and C. G. Peters, physicists at the National Bureau of Standards, who assisted with research projects on behalf of the Diamond Die Section of the War Production Board.

✦ ✦ ✦

Silver Alloy Brazing

PRODUCTION speed and perfection are paramount with the Chemical Warfare Service. An article entitled Silver Alloy Brazing by Col. Harry R. Lebkicher, Commanding Officer, Chicago Chemical Warfare Procurement District, shows, step by step, with photographic illustrations, the methods and materials used in silver alloy brazing in the Chemical Warfare Service.

✦ ✦ ✦

THE article offers detailed explanations of the CWS procedure and preparation for low melting silver alloy brazing in large conveyorized and continuous production lines. Methods of cleaning and heating, and other operations are covered in full. Production rates are given. The properties and advantages of low temperature silver alloy brazing are reviewed.

✦ ✦ ✦

MANUFACTURERS expecting to include low temperature silver alloy brazing in their post-war assembly methods can obtain copies of this article from **Handy & Harman**, 82 Fulton Street, New York 7, N. Y.

VIANNEY
Famous Wire Drawing Diamond Dies

These famous Diamond Dies are now produced here at moderate prices.

All sizes are in stock or made to order to your specifications

VIANNEY WIRE DIE WORKS
250 E. 43rd St., New York.
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SPRING FORMING TOOLS and GUIDES

MADE TO EXACT TOLERANCES BY MODERN PRECISION METHODS

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Also do special precision finishing on carbide wire drawing dies all shapes and sizes.

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DIAMOND DIES

for DRAWING WIRE

as made by WAYNE represent everything in quality and workmanship that manufacturers of fine wire:

STEEL • ALLOY
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TUNGSTEN and OTHER METALS,

desire for long die life, good finish and economy.

Users of Wayne Dies state: "They are the best value obtainable"

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Wire Drawing Diamond Dies

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Major Improvements Made in Radiamatic by Brown Instrument

FIVE major improvements, just introduced in Radiamatics, will make this compensated radiation pyrometer secure against air and gases up to one pound per square inch gauge pressure at temperatures up to 250 degrees Fahrenheit, it is announced by the Brown Instrument Company, Philadelphia. These are:

1. An adhesive sealing compound between the lens and mounting ring; 2. Brass for lens retaining and mounting rings; 3. Controlled torque applied when assembling the lens retaining and mounting rings; 4. Two spanner wrench holes in lens mounting ring face have been replaced with a milled slot which avoids cutting through the ring face; and, 5. A more positive sealing, with an improved adhesive, of the sighting glass located in the rear of the thermopile assembly.

✦ ✦ ✦

OTHER improvements include use of aluminum instead of cast iron for the Radiamatic housing. This latter development will be applied to all Radiamatics shipped after March 1.

✦ ✦ ✦

THE Radiamatic pyrometer is designed primarily to meet exacting demands of steel mills, metallurgical works, ceramic plants and related industries. It consists essentially of a heat resisting lens, a compensator and a thermopile. Energy radiated from the hot object being measured falls on the lens and is focused on the thermopile which generates an e.m.f. proportional to the object's temperature. The measurements are independent of ambient temperatures.

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TUNGSTEN CARBIDE HEADING DIES HAVE INCREASED PRODUCTION AS MUCH AS TWENTY TIMES MAY WE HELP YOU TO INCREASE YOURS?

We Carry Stock of Wire Drawing Dies for Immediate Shipment

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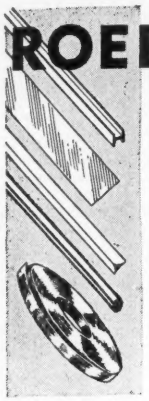

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Wire Drawing Machinery

Featuring —
High Speed Upright Cone Machines.
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Bull Blocks and Benches, Continuous Wire Drawing Machines Spoolers, Pointers, String-up Machines, etc.
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13 models in both segment and clutch types for rapid, automatic, **accurate** production using wire diameters .033" to .500". Torsion and other attachments available for increasing utility of Torrington Coilers.

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Rod Frames — 16" Frames, 8" Frames — Take-Up Frames, Wire Pointers — Puller Tongs.

General and heat resisting alloy castings for wire mill use.

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Bulletin Describes New Air Heater

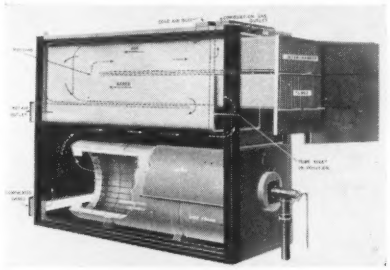
THE J. O. Ross Engineering Corporation, 350 Madison Avenue, New York 17, N. Y., have issued a bulletin describing and illustrating a new type of recirculating indirect air heater said to attain higher efficiency, not by operating at higher gas temperature, but by an entirely new principle of recirculating gasses.

✦ ✦ ✦

THE new heater is built in only one outlet temperature range, 500° to 600° F., but other Ross heaters permit of a large selection of outlet temperatures of air volumes and outlet temperatures, should these be required.

✦ ✦ ✦

A fuel efficiency of 85% and over is said to be secured in this new heater, the arrangement of parts that



ROSS HEATER

make up the heater being shown in the illustration. The gasses and air travel in counter-flow direction with maximum effective temperature differential. Fuel is completely burned in the combustion chamber with a minimum of makeup air, with resultant temperatures of 2000° to 2800° F. The hot gasses are then diluted with the cooler recirculating gasses brought back from the heater exhaust gas outlet by means of a fan.

✦ ✦ ✦

OIL or gas may be used as fuel. The heater is made in two sizes: R 75, with 75,000 BTU per hour output and R-100, with 100,000 BTU per hour output.

✦ ✦ ✦

COPIES of the bulletin may be secured by writing the Company.

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THE 1945 REGIONAL MEETINGS

The Annual Worcester and Pittsburgh Regional Meetings originally scheduled for April and May, respectively, will not be held this year, as the directors have deemed it advisable to cancel them in conformity with the request of the Office of Defense Transportation in Washington, D. C.

While it is possible to hold technical sessions bearing on the war production problems by securing permission, it has been considered wiser to conform to the spirit and necessities of the war situation and plan for better meetings later on when conditions are more auspicious.

THE WIRE ASSOCIATION
Richard E. Brown, Executive Secretary
300 MAIN ST. STAMFORD, CONN.

Electronic Vulcanization Patents Purchased by Firestone and Goodrich

ANNOUNCEMENT has been made that basic patents covering electronic vulcanization of rubber and other materials have been purchased by **The B. F. Goodrich Company** and **The Firestone Tire & Rubber Company.** The patents were originally granted on discoveries made by **R. A. Dufour** and **H. A. Leduc** of France, and by **E. E. W. Kassner** of Switzerland.

✦ ✦ ✦

IN making the announcement the rubber companies stated that the patents would be made available both to the rubber and plastics industries on a reasonable basis believing that this policy will speed electronic development ultimately making available to consumers improved rubber and plastics products at lower costs.

✦ ✦ ✦

IT was stated that rapid steps had been made in creating "more uniform and higher quality products with great savings in time" through electronic vulcanization.

✦ ✦ ✦

VULCANIZATION is the joining of rubber molecules and sulphur. For more than a century, rubber has been vulcanized by applying heat to the outside surfaces. Since rubber insulates against rather than conducts heat, heating of rubber products, to their core was slow and lacking in uniformity. Plastics also do not readily conduct heat, and molding them has presented similar difficulties.

✦ ✦ ✦

IN electronic vulcanization, high frequency oscillations shake the molecules of rubber and sulphur millions of times a second, creating uniform heat throughout the product being vulcanized in a fraction of the time required when steam is used. The same uniform heating removes difficulties in the molding of thick plastic products. Electronic heating also makes possible the use of simplified equipment.

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Newark 5, N. J.

RUESCH
Machinery For
Wire, Tube, and Brass Mills
409 Mulberry St., Newark, N. J.

INVESTIGATIONS indicate that the excellent results obtained by electronic vulcanization are due not only to rapid uniform heating, but also may be connected in some way with electronic power itself, which creates qualities not found when present methods of curing are used.

✦ ✦ ✦

Bulletin on Synthetic Wax

THE Glyco Products Co., Inc., Brooklyn, New York, announces the publication of a 16 page bulletin entitled, "A High Melting Point Synthetic Wax." This gives detailed information on the high melting point synthetic Wax produced by the Company under the name of Acrawax C.

✦ ✦ ✦

THIS wax has demonstrated some outstanding qualities when used in several varied industrial applications. Its exceptionally high melting point (280°F), inertness, and water repellent characteristics, are a few of the features which have lent themselves to many new industrial developments in the fields of adhesives, electrical insulation, varnishes and lacquers, plastics, textiles, and in the field of elastomers.

✦ ✦ ✦

THESE properties are listed and indexed in the bulletin, and specific applications of the wax are mentioned in detail.

✦ ✦ ✦

A copy of the bulletin will be mailed free to any chemist or technical worker who requests the same.

✦ ✦ ✦

Industrial Cleaning and Allied Process Equipment

A new Bulletin (No. 4E1) has been published by the **Optimus Equipment Company,** 251 Church Street, Matawan, N. J., manufacturers of washing, rinsing, pickling, and drying equipment for metal parts. It describes a complete manufacturing and engineering service offered covering units from the smallest portable type to complete automatic equipment including an entire series of metal cleaning and allied process operations. If interested, write for a copy.

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THE BUYERS GUIDE is a complete directory of all kinds of wire and wire products manufactured in this country, together with listings of all manufacturers of machinery, equipment, supplies and services used by the Wire Industry.
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WIRE PRODUCTS
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WHERE TO BUY

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Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION—
Ceilcote Co., The, Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio
Nukem Products Co., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

AIR DRAW FURNACES—
Carl-Mayer Corp., The, Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

ANNEALING MACHINES—
Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio
Morgan Construction Co., Worcester, Mass.
Moslo Machinery Co., Cleveland, Ohio.

BELTS—Wire
Wickwire Spencer Co., New York, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE—
Norton Co., Worcester, Mass.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Co., Buffalo, N. Y.

CABLE LACQUERING OVENS
Industrial Oven Engr. Co., Cleveland, Ohio.

CABLE—Steel and Copper
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Wickwire Spencer Steel Co., New York, N.Y.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

CASTINGS—Wire Mill
Scudder, E. J., Fdry. & Machine Co., Trenton, N. J.

CEMENTS—Acid Proof
Sauereisen Cement Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.
Broden Construction Co., Cleveland, O.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Haveg Corporation, Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Nukem Products Corp., Buffalo, N. Y.
Vaughn Machinery Co., Cuyahiga Folls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott, Henry L., Co., Providence, R. I.

CLOTH—WIRE, All Metals
Roebling's, John A. Sons, Co., Trenton, N. J.
Wickwire Spencer Steel Co., New York, N. Y.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Gilron Products Co., Cleveland, Ohio.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

COLD HEADERS—
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds, Inc., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Gilron Products Co., Cleveland, Ohio.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago, Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vianney Wire Die Wks., New York, N. Y.

DIAMOND POWDERS—
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIAMOND TOOLS—
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
United Die Co., Newark, N. J.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Wopis Industry Laboratory, Brooklyn, N. Y.

DIES—Lead Extrusion
Carb-Tung Products, Inc., Brooklyn, N. Y.
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Inc., Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Carb-Tung Products, Inc., Brooklyn, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Hartley Wire Die, Thomaston, Conn.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Metal Carbides, Inc., Youngstown, Ohio.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg. N. J.
Carbide Die Works, Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Carb-Tung Products, Inc., Brooklyn, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides, Inc., Youngstown, Ohio.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.
Wopis Industry Laboratory, Brooklyn, N.Y.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Carb-Tung Products, Inc., Brooklyn, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Metal Carbides, Inc., Youngstown, Ohio.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.
Wopis Industry Laboratory, Brooklyn, N. Y.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N. J.
Carbide Die Works, Inc., Hartford, Conn.
Carboloy Co., Inc., Detroit, Mich.
Carb-Tung Products, Inc., Brooklyn, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Hartley Wire Die, Thomaston, Conn.
Kelly Wire Die Corp., New York, N. Y.
Luginbill Wire Die Co., Fort Wayne, Ind.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N. Y.
Tungsten Electric Corp., Union City, N. J.
United Die Co., Newark, N. J.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J.
Standard Machinery Co., Providence, R. I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING & PRE-HEATING ROOMS
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

DRYING EQUIPMENT
Carl Mayer Corp., Cleveland, Ohio.

ELECTRIC RESISTANCE HEATING
Trauwood Engr. Company, Cleveland, Ohio.

ENGINEERS—Consulting Wire Mill
Hartley, George D., Worcester, Mass.
Lewis, Kenneth B., Worcester, Mass.

EQUIPMENT—Humidifying
Niagara Blower Co., Buffalo, N. Y.

EQUIPMENT—Insulation Testing
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, James L., Co., Pawtucket, R. I.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FENCES AND FENCING—Wire
Wickwire Spencer Steel Co., New York, N.Y.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M., Co., Pittsburgh, Pa.

WHERE TO BUY, Continued

FRICTION PAY-OFF STANDS—
Industrial Oven Engr. Co., Cleveland, Ohio.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.

FURNACES—Galvanizing Equip.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Div. of Gen'l Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engineering Co., Cleveland, O.

FURNACES—Hard'ing & Temp'ing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engr. Company, Cleveland, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Wilson, Lee, Engineering Co., Cleveland, O.

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio

FURNACES—Salt Bath
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Electric Furnace Co., Salem, Ohio.
Pennsylvania Industrial Engrs., Pittsburgh, Pa.
Surface Combustion, Div. of General Properties Co., Inc., Toledo, Ohio.
Trauwood Engineering Co., Cleveland, Ohio
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING KETTLES
National Annealing Box Co., Washington, Penna.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Oven Engr. Co., Cleveland, Ohio.

INSULATING MATERIALS—
Angier Sales Corp., Framingham, Mass.
Crepe-Kraft Co., Newark, N. J.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry & Machine Co., Waterbury, Conn.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Robertson, John, Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Fidelity Machine Co., Philadelphia, Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY— Coilers
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J. (for Tungsten Wire)
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila., Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Cutting
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Porter, H. K., Inc., Everett, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Die Making
Carboloy Co., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co., Montclair, N. J.

MACHINERY—Draw Benches
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Edging
Broden Construction Co., Cleveland, Ohio.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Oven Engineering Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson, John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Fence
Broden Construction Corp., Cleveland, Ohio
Glader, Wm., Machine Works, Chicago, Ill.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark 3, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY— Forming
Eisler Engineering Co., Newark 3, N. J.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Fidelity Machine Co., Philadelphia, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Knitting
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John, Co., Brooklyn, N. Y.

WHERE TO BUY, Continued

MACHINERY—Lead Stripping
Robertson, John, Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Brockton, Mass.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Nail and Tack
Broden Construction Co., Cleveland, Ohio.
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Pointing
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Quill Winding
Fidelity Machine Co., Philadelphia, Pa.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Rubber for Insulating Wire
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John, & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Emory, Robert J., Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Nilson, A. H., Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs)
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Emory, Robert J., Co., Newark, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
National Machinery Exchange (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, Ohio.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
National Machinery Exchange (Used), New York, N. Y.
Nilson, A. H., Machine Co., The, Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Construction Co., Cleveland, Ohio.
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Swaging
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Equipment—Sparkers
Davis, R. L., Electric Co., Wallingford, Conn.
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mflls
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co, Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark 3, N. J.
Fidelity Machine Co., Philadelphia, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co, Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up
Entwistle, Jas. L., Co., Pawtucket, R. I.
Industrial Oven Engr. Co., Cleveland, Ohio.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark 3, N. J.
Nilson, A. H., Co., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila., Pa.
Broden Construction Co., Cleveland, Ohio.
Eisler Engineering Co., Newark 3, N. J.
Morgan Construction Co., Worcester, Mass.
National Machinery Exchange (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Wire Measuring
Durant Mfg. Co., Milwaukee, Wis.
Lyon-Vail Machine Co., Inc., Brockton, Mass.
New England Butt Co., Providence, R. I.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Machinery Exchange (Used), New York, N. Y.

MATERIAL HANDLING EQUIP.
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co, Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburg, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Philadelphia, Pa.
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Industrial
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio.
Industrial Oven Engr. Co., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—Insulating
Angier Sales Corp., Framingham, Mass.
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott, Henry L., Co., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D. C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Sauereisen Cement Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, The, Co., Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.

PLASTIC TESTERS—
Scott, Henry L., Co., Providence, R. I.

POTS—Lacquer
Industrial Oven Engr. Co., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co., Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Homer, N. Y.
Magnus Chemical Co., Garwood, N. J.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

WHERE TO BUY, Continued

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Fidelity Machine Co., Philadelphia, Pa.
Industrial Oven Engr. Co., Cleveland, O.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Traverse
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REFRACTORIES—High Temperature
Norton Co., Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.

RODS—Wire—Non-Ferrous
Aluminum Co. of America, Pittsburgh 19, Pa.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Brewer Mfg. Co., Muncy, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott, Henry L., Co., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

SATURATION SYSTEMS—
Industrial Oven Engr. Co., Cleveland, Ohio.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Proctor & Gamble, Cincinnati, Ohio.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Oven Engr. Co., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Steel
Wickwire Spencer Steel Co., New York, N. Y.

STAMPINGS—Steel
Hubbard Spool Co., Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRAND—Steel and Copper
Brewer Mfg. Co., Muncy, Pa.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

STRIP METAL TESTERS—
Scott, Henry L., Co., Providence, R. I.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.
Nukem Products Corp., Buffalo, N. Y.

TANKS—Pickling
Ceilcote, The, Co., Cleveland, Ohio
Haveg Corp., Newark, Del.
Heil Engineering Co., Cleveland, Ohio.
Nukem Products Corp., Buffalo, N. Y.
Sauereisen Cements Co., Pittsburgh, Pa.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Pa.

TEMPERATURE CONTROLS—
Niagara Blower Co., Buffalo, N. Y.

TENSILE TESTERS—
Scott, Henry L., Co., Providence, R. I.

TESTING INSTRUMENTS—
Davis, R. L., Electric Co., Wallingford, Conn.
Scott, Henry L. Co., Providence, R. I.

TOOLS—Wire Cutting
Porter, H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio.

TRAVERSES—
Hubbard Spool Co., Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio

TREADS—Safety
Norton Co., Worcester, Mass.

TRUCKS—
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS—
Ruesch, H. J., Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power Driven
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark 3, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Philadelphia, Pa.
Entwistle, James L., Co., Pawtucket, R. I.
Industrial Oven Engr. Co., Cleveland, Ohio.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh 19, Pa.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A. Sons, Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.

WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A. Sons, Co., Trenton, N. J.
Spencer Wire Co., West Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE—Music
Spencer Wire Co., West Brookfield, Mass.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Spencer Wire Co., West Brookfield, Mass.

WIRE—Non-Ferrous to Specification for Special Purposes
Hudson Wire Co., Ossining, N. Y.
North American Philips Corp., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Spencer Wire Co., West Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.

WIRE—Stainless Steel
Firth-Sterling Steel Co., McKeesport, Pa.
Spencer Wire Co., West Brookfield, Mass.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's, John A. Sons, Co., Trenton, N. J.
Spencer Wire Co., West Brookfield, Mass.
Wickwire Spencer Steel Co., New York, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE TESTERS—
Scott, Henry L., Co., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

YARN TESTERS—
Scott, Henry L., Co., Providence, R. I.

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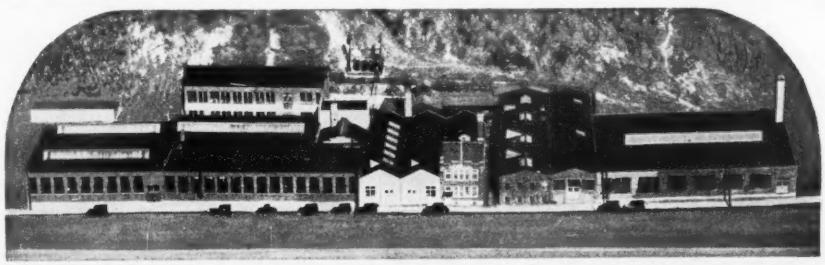

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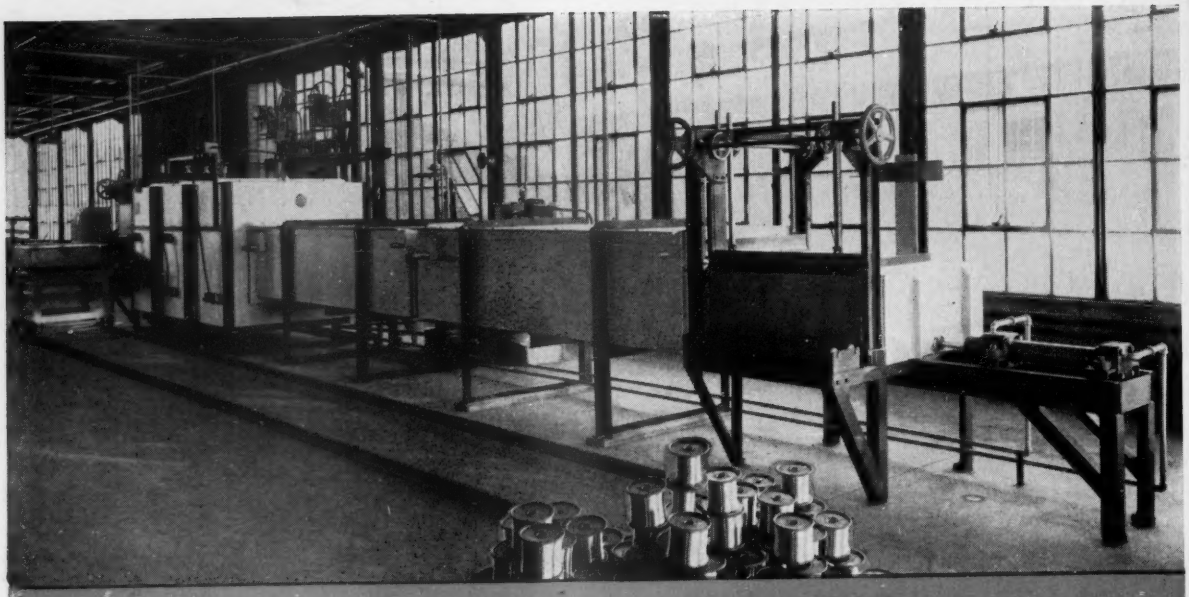

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For Handling Wire on Spools,
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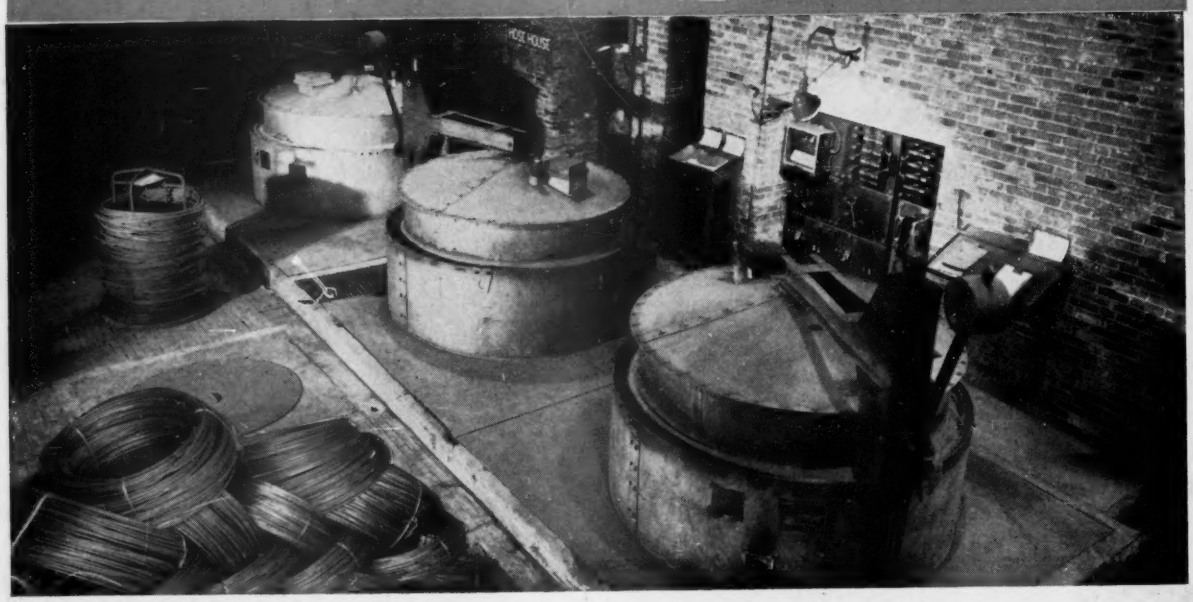
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